Analysis of the Effects of Best Management Practices in Cotton on Runoff Water Quality

Final Report

submitted to

Louisiana Department of Environmental Quality

in fulfillment of

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EDITOR'S NOTE:

Several of the personnel who signed off on CFMS Contract No. 506814, "Analysis of the Effects of Best Management Practices in Cotton on Runoff Water Quality", are no longer employed at the University of Louisiana-Monroe (formerly Northeast Louisiana University). The two principal investigators for the project, Dr. Kathy McLean and Mr. Bob Neal, the department head of Agriculture, Dr. Mike Gould, and Dr. Paul Ferguson, Dean of Graduate Studies, all have assumed positions at other universities. Dr. Ron Smith, Dean of the College of Pure and Applied Sciences at that time, has retired. Dr. John Barnett, former County Agent, Ouachita Parish (county), has been promoted to Cotton Specialist at the Louisiana State University Agriculture Center, Winnsboro, LA.

The information reported in this document has been gleaned from Quarterly Reports to Louisiana Department of Environmental Quality (LDEQ), the raw data, and from personal observations of the editor while collecting runoff samples after specific rainfall events.

This Final Report is provided to LDEQ in fulfillment of the project Scope of Services requirement for results/discussion from the several project elements including soil and water quality, cotton production, and other components listed in the contract.

H. C. Bounds

Analysis of the Effects of Best Management Practices in Cotton Runoff Water Quality

PROJECT SUMMARY

Four cotton production scenarios, a control and three best management practices (BMPs), were compared during a two-year demonstration project as to their effect on runoff water quality in the Bennett Bayou watershed of Ouachita Parish, Louisiana. The research was conducted during the 1997 and 1998 growing seasons.

The four management options consisted of:

a) Option 1, conventional tillage practices (included nutrient and pesticide management which served as the control);

b) Option 2, conventional tillage, plus a winter cover crop;

c) Option 3, conservation tillage with nutrient and pesticide management;

d) Option 4, conservation tillage plus a cover crop and a transgenic variety of cotton.

The demonstration fields were arranged in a randomized block design with three replications. Runoff samples were collected after selected rain events during each major production practice from planting to harvest, i.e., pre-plant, post-plant, early, mid-, and late-season operations, and at mid-winter. The parameters for the rain events were

a) at least 0.5" rainfall but

b) less than 3.5" within a 1-hour duration.

These restrictions allowed for a long duration, low intensity rainfall and a short duration, high intensity event, both of which occur during the spring and summer seasons.

The amount of runoff water was recorded as gallons per minute peak discharge. The runoff samples were tested for total suspended solids (TSS), volatile solids (VS), total Kjeldahl-N (TKN), total phosphorus (PO_4=), ammonium-N (NH_4+), nitrate-N (NO_3-), pH, and priority pesticides used during the growing season.

A significant difference was observed between the BMPs in regards to *amount of runoff*, with Option 4 producing the greatest amount. However, *runoff water quality* was found to be significantly better in Option 4 as determined by reductions in TSS, VS, TKN, PO_4=, and soil applied pesticides as compared to the other options. There was no significant difference between the options in regards to NH_4+ or NO_3- concentrations in the runoff waters.

A significant difference also was observed between *production events* (pre-planting, post-planting, etc.) for each parameter tested, including soil pH.

Cotton yield from the various options produced 2-year averages of 885 lbs/A lint cotton for Option 1, 1052 lbs for Option 2, 948 lbs for Option 3, and 1147 lbs/A for Option 4. During 1997, the difference in yield between the highest and lowest options was 458 lbs/A, while in '98 the yield difference was only 66 lbs/A.

Economic analysis of the four treatments showed that each treatment had a positive return during the 1997 season, but there was a significant difference between the two treatments with cover crops (Option 4, conservation + cover @ $350.52/A; Option 2, conventional + cover @ $213.47/A) and the two options without cover crop (Option 1, control @ $6.31/A; Option 3, conservation alone @ $18.73/A). During the 1998 season, each treatment resulted in a negative profit. The two conservation tillage treatments lost less than the two conventional operations (Option 1 @ -$170.10/A; Option 2 @ -$136.67/A; Option 3 @ -$74.27/A; Option 4 @ -$77.87/A). Considering both years of the test period, conservation tillage plus cover (T4) produced the greatest profit ($272.65/A).

Soil nematode populations fluctuated over the test period from Fall 1996 to Spring 1998. The greatest increase in numbers per 250 cc soil occurred during Fall 1997 and Spring 1998, with Option 3 (conservation tillage alone) yielding the largest amount. The average values were Option 1 = 2143, Option 2 = 2951, Option 3 = 4081, and Option 4 = 2516.

A cumulative total of 93 species of plants (71 herbaceous, 22 woody) were found during the study at four locations along Bennett Bayou (L1 = farthest upstream; L2 = just above BMPs; L3 = just below BMPs; L4 = farthest downstream). The highest number of species was consistently found at location L3, just below the BMP site. This was interpreted to mean the BMPs had no detrimental effect on the bayou flora.

A survey of ostracodes (microscopic crustaceans) was similar to the floristic survey in that the only species found were typical of shallow-dwelling freshwater species, i.e., normal freshwater community.

It is estimated that if the best management practice of conservation tillage plus a winter cover crop were adopted on all the farm land that drains into Bennett Bayou, a 67% reduction in total suspended solids and a 45-60% reduction in soil-applied pesticides would occur within the watershed.

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INTRODUCTION

The non-point source pollution of water resources by agricultural runoff is a key issue now shaping agricultural production practices and related governmental policies. Cotton is considered a chemical-intensive crop, using fertilizer, insecticides, herbicides, and defoliants. Essentially all cotton production acres are treated with fertilizers and/or pesticides. These production practices were determined originally for profit potential rather than consideration of environmental effects. Recently, however, work has been conducted by agricultural researchers on developing production practices which reduce environmental damage, such as possible alternatives for mitigating contamination of waterways by highly leachable pesticides. These practices are referred to as "Best Management Practices".

Best Management Practices (BMPs) are production practices aimed at solving a specific resource problem. The primary function of these practices is to improve the ecosystem and ensure sustainable agricultural production through reducing soil erosion, nutrient and pesticide runoff, and improving ground or surface water. Previous agriculture demonstration projects funded by the Louisiana Department of Environmental Quality (LDEQ) have demonstrated the effectiveness of BMPs in sugarcane and rice production. In 1992, a coalition of representatives from agricultural commodity groups, the Natural Resources Conservation Service (NRCS), Louisiana Farm Bureau Federation (LFBF), the Louisiana Department of Agriculture and Forestry, LDEQ, and the Louisiana State University Ag Center developed a detailed report on BMPs for cotton. This project used the recommendations of the coalition group to establish, implement, and evaluate a BMPs demonstration project concerning runoff water quality. In addition, it provided a location where farmers could see the types of BMPs recommended by the Non-point Source Management Plan (NPS).

At the time the project was initiated, there was a need for on-farm demonstration in the Mississippi delta region that would examine the differences in runoff water quality between varying BMPs utilizing delta cotton production practices. This project was conducted in small demonstration fields on an 18-acre portion of the Killoden Plantation, which is adjacent to Bennett Bayou in eastern Ouachita Parish (county). During the project period (1997 - 1998), the remaining acreage of the Killoden Plantation was also in cotton production. The Bennett Bayou watershed, of which this plantation is a part, includes runoff from several different types of land uses, consisting of approximately 10 percent urban land, 10 percent forest land, 5 percent pasture land, and 75 percent cropland. Bennett Bayou drains into Bayou LaFourche. Bayou LaFourche is documented as an impaired waterway by the LDEQ.

Bayou LaFourche, represented in water quality management sub-segment 080904, is partially meeting its designated use. Suspected sources of water pollution include irrigated crop production, non-irrigated crop production, and other sources unrelated to agriculture. Suspected causes include pesticides, priority organics, nutrients, organic enrichment/low dissolved oxygen (DO), suspended solids, and turbidity.

OBJECTIVES

The objectives of this project were to demonstrate cotton BMPs, gather runoff water quality data and information concerning the BMPs effectiveness in reducing non-point source pollutants associated with cotton production, produce an economic evaluation concerning the implementation of the BMPs, establish an educational program to encourage implementation of the evaluated BMPs throughout the watershed, and to propose a watershed protection strategy for the Bennett Bayou watershed.

PROJECT DESCRIPTION

A description of the four management schemes used is as follows:

1. Conventional tillage cotton production system (includes nutrient management and integrated pest management practices).
2. Conventional tillage cotton production system plus a winter cover crop* with nutrient and pest management practices.
3. Conservation tillage system** with both nutrient and integrated pest management.
4. Conservation tillage system** with a transgenic cotton variety and nutrient management, integrated pest management, and a cover crop*.

(BMPs recommended by the LSU Ag Center publication, Agronomic Crops BMPs, include use of winter cover crops and adopting conservation tillage methods** to reduce soil erosion, or a combination of both)*

Evaluation of BMPs included collection of flow weighted runoff samples of selected rainfall events during each of the major stages of cotton production:

a) Pre-plant or field preparation (includes all tillage and /or pesticide applications made prior to planting)
b) Planting/post-emergence (tillage practices, pesticide applications made from during/after planting to just prior to squaring of the cotton).

c) Early season (tillage and pesticide applications from squaring to first bloom).
d) Mid-season (tillage and pesticide applications from first bloom to peak bloom).
e) Late season (tillage and pesticide/defoliant applications made from "cutout" to harvest).
f) Winter (fallow) period.

This sampling scheme provides when the greatest potential for non-point source pollutant loading occurs during the production period. In addition, analysis of the runoff samples proves the effectiveness of the BMPs for the reduction of non-point source pollutants associated with cotton production.

In addition to the cotton BMPs demonstration project, three other topics were investigated:

1) Economic analysis of each of the management schemes to determine if the proposed BMPs are economically feasible.

2) Education and outreach activities in the form of field days were hosted to demonstrate BMPs, provide information concerning economic feasibility, and to disseminate non-point source pollution materials.

3) Watershed evaluation of non-point source pollutants contributed to Bennett Bayou. The resulting information provided an estimation of whether water quality standards could be met for watershed protection with the use of various BMP in cotton production.

METHODOLOGY

Best Management Practices (BMPs)

1. <u>Conventional tillage cotton production system:</u>

Preparation:
In late March to early April the field was disked twice. In mid April, a pre-plant dinitroanaline (DNA) herbicide was broadcast and incorporated by disking to control grasses and some broadleaf weeds. Immediately following herbicide application, the field was again disked and rows formed with a hipper. In late April to early May, immediately before planting, the rows were smoothed with a bed conditioner. Fertilizer was applied as recommended by soil analysis (see Appendix D).

Planting:
Cotton was planted on 40-inch rows with an 800 series International planter at a seeding rate of 6 seeds/ft row (78,000 seed/A). An in-furrow granule insecticide (Aldicarb) and fungicide (Terraclor) also was incorporated one inch above and to the side of the seed furrow during planting. Pre-emergence herbicides (Fluometuron and Metolachlor) were applied as a broadcast spray behind the planter.

Early Season:
Fertilizer normally was applied two weeks after planting either as a dry formulation broadcast on the surface or as a liquid knifed in 10 inches from the center of the row. Plots were cultivated and post emergence herbicides (Fluometuron and MSMA or prometryn + MSMA) applied twice until layby (approximately July lst). Early season insect populations, if observed by the field consultant, were controlled with insecticide applications applied at maximum levels following the Louisiana Cooperative Extension Service Cotton Insect Control Guides, 1997 and '98.

Mid Season:
Mid season insecticide applications were applied as recommended by the field consultant. Insecticide applications of methyl parathion for cotton boll weevil control were applied twice weekly. Cotton bollworms and tobacco budworms were controlled with pyrethroids applied once a week when indicated by pest management surveys. All insecticides were applied as a broadcast spray by ground rig. ***Editor's NOTE: This project was conducted prior to the initiation of the Boll Weevil Eradication Program (BWEP) for this area. Boll weevil control is now authorized only by the BWEP and uses malathion on an "as needed basis" determined by field trapping.***

Late Season:
Late season insecticide application was applied as recommended by the field consultant. Insecticide applications of methyl parathion for cotton boll weevil control continued to be applied twice weekly. Cotton bollworms and tobacco budworms were controlled with organophosphates applied once a week by a ground rig. When plants were mature to approximately 60% open bolls, the cotton was defoliated (approximately September lst) with paraquat dichloride and harvested by hand 10 to 14 days later. Soil samples taken after harvesting followed the methods recommended by the Louisiana Cooperative Extension Service.

Fall/Winter:
During mid-October to early November, the cotton stalks were shredded. Stalks were cut at least 10 inches above the soil surface to produce residue for erosion control.

2. Conventional tillage cotton production system with nutrient management, integrated pest management, and cover crop.

Preparation:
In late March to early April, each test plot was disked twice and treated the same as just described for the conventional system without a cover crop. The planting rate of seed and incorporation of in-furrow insecticides/fungicides were made as previously detailed. Insect control throughout the growing season was made on an *as needed* basis determined by the field consultant (Integrated pest management).

Fall:
The winter cover crop, wheat, was broadcast over the top in mid-October or early November. The cotton stalks were shredded immediately after seeding the cover crop. Stalks were cut at least 10 inches above the soil surface to hold the residue in place.

3. Conservation tillage system with nutrient and integrated pest management.

Preparation:
In early March, the plots were inspected for weeds and a burn-down herbicide (Roundup or Paraquat) was applied to kill winter annual weeds. By late March to early April, the rows were re-hipped. Pre-plant DNA herbicides were broadcast and incorporated using a rolling cultivator or bed conditioner adjusted to incorporate herbicides without knocking off much soil from the row. Fertilizer application was made at this time if recommended by soil analysis. Immediately before planting, the rows were smoothed with a bed conditioner.

Planting:
Cotton was planted on 40-inch rows with a 800 series International planter at a seeding rate of 6 seed/ft row (78,000 seed/A). An in-furrow granule insecticide (Aldicarb) and fungicide (Terraclor) were incorporated one inch above and to the side of the seed furrow during planting. Pre-emergence herbicides (Fluometuron and Metolachlor) also were applied as a broadcast spray behind the planter.

Early Season:
Fertilizer was applied two weeks after planting as recommended by soil analysis. Post emergence herbicides (Fluometuron and MSMA or Prometryn + MSMA) applied. Early season insects were controlled following the field consultant's recommendation in accordance with the integrated pest

management plan of the Louisiana Cooperative Extension Service Cotton Insect Control Guide 1997 and 1998.

Mid Season:
Mid season insecticide applications were applied as recommended by the field consultant following integrated pest management techniques to control insect pests when their populations reached economic thresholds. The cotton boll weevil was controlled with applications of methyl parathion only when weevil populations reached economic thresholds. Cotton bollworms and tobacco budworms likewise were controlled with pyrethroids only if populations reached economic thresholds. All insecticides were applied as broadcast sprays by a ground rig or as spot treatments to infested areas. Cotton petioles samples were collected to determine if nutrients were limited and a fertilizer application made if necessary.

Late Season:
Late season insecticide applications again were applied as recommended by the field consultant. The cotton boll weevil continued to be controlled with applications of methyl parathion only when weevil populations reached economic thresholds instead of automatic twice-per-week applications (management option #1). Cotton bollworms and tobacco budworms were controlled with organophosphates only when populations reached economic thresholds. Insecticides were applied as broadcast sprays by a ground rig or as spot treatments to infested areas. When plants were mature to approximately 60% open bolls, the cotton was defoliated (approximately September lst) with paraquat dichloride and harvested by hand 10 to 14 days later. Soil samples were collected after harvesting.

Fall:
During mid-October to early November, the cotton stalks were cut and shredded at least 10 inches above the soil surf ace to hold the residue in place.

4. Conservation tillage system with nutrient management, cover crop, integrated pest management and transgenic cotton.

Preparation:
In early March the field was inspected for weeds and a burn-down herbicide (Roundup or Paraquat) applied to kill winter annual weeds. By late March to early April, the rows were re-hipped, pre-plant DNA herbicides were broadcast and incorporated, fertilizer application was made as recommended by soil analysis, and the rows were smoothed with a bed conditioner as previously described for conservation tillage (management option #3).

Planting:
Cotton was planted on 40-inch rows with a 800 series International planter as were all plots. In-furrow granule insecticide (Aldicarb) and fungicide (Terraclor) were incorporated one inch above and to the side of the seed furrow during planting. Pre-emergence herbicides (Fluometuron and Metolachlor) were applied as a broadcast spray behind the planter.

Early Season:
Fertilizer was applied two weeks after planting as recommended by soil analysis. Post emergence herbicides (Fluometuron and MSMA or Prometryn + MSMA) applied. Early season insects were controlled following the integrated pest management recommendation of the field consultant according to the Louisiana Cooperative Extension Service Cotton Insect Control Guide 1997 and 1998 for thresholds and insecticides.

Mid Season:
Mid season insecticide applications were made as recommended by the field consultant when insect pest populations reached economic thresholds. The cotton boll weevil was controlled with applications of methyl parathion and cotton bollworms were controlled with pyrethroids when recommended by the field consultant. Insecticides were applied as a broadcast sprays by a ground rig or as spot treatments to infested areas. Cotton petioles for this treatment regime were collected to determine if nutrients were limited and a fertilizer application made as necessary. ***Editor's Note: The transgenic cotton variety used, NuCotn 33, provides tobacco budworm control but sometimes must be treated for cotton bollworms when populations reach economic thresholds.***

Late Season:
Late season insecticide applications were applied as recommended by the field consultant again following the integrated pest management scheme. The cotton boll weevil continued to be controlled with applications of methyl parathion only when weevil populations reach economic thresholds. Cotton bollworms were controlled during late season with organophosphates only if populations reach economic thresholds. When plants matured to approximately 60% open bolls, the cotton was defoliated (approximately September lst) with paraquat dichloride and harvested by hand 10 to 14 days later. Soil samples were taken after harvesting.

Fall:
During mid-October to early November, the winter wheat cover crop was broadcast. Cotton stalks were shredded immediately after seeding to protect the cover crop and to hold the residue in place.

Site Layout/ Experimental Design

The site on which the plots were established was precision leveled to ensure each plot drained to the determined collection point. The area around each plot was leveled to ensure no cross drainage from the remainder of the field. The site for the plots was approximately 10 acres of which approximately 2 acres was in production. The plots were arranged in a randomized block design and replicated three times. Each plot was partitioned form other plots by 12" levees placed on 12-row sections of a cotton field with less than 1% slope. Each plot emptied into a single grassy waterway which, in turn, emptied into Bennett Bayou.

The demonstration fields and management systems are listed in Appendix A, Project Area. A runoff water sample was collected after a rainfall event during each of the following production practices: pre-planting, post-planting, early season, mid-season, late season, and winter. The time increments between runoff water sampling was originally planned to be at 3- to 4-week intervals during preparation through the harvest stages and then approximately 8 weeks between harvest and mid-winter, and preparation the following year. However, runoff water samples were collected whenever a sufficient rainfall event occurred (normally at least 0.5" rainfall). Composite runoff flow weighted samples were collected by automatic samplers (ISCO) donated by LDEQ. Water samples were transported to the University of Louisiana-Monroe (ULM; formerly NLU) Soil Plant Analysis Lab and analyzed for ammonium ion, nitrates, nitrites, phosphorus, total dissolved solids, total suspended solids, and selected pesticides (scan for priority pollutants) following processing procedures described in the Quality Assurance Project Plan for Surface Water Monitoring and Analysis (contained in a separate document). The quantities of these non-point source pollutants were analyzed statistically by Analysis of Variance (ANOVA) and the four management schemes compared at the 0.95 level of significance. Results from the ANOVA were used to statistically indicate the effectiveness of minimum tillage and winter cover crop systems in reducing non-point source pollutants from entering the bayou compared to conventional production system.

Crop Monitoring

The effects of the four management options on cotton production were monitored throughout the growing season by determining percent seedling stand after planting, by measuring plant height and number of nodes, and by final yield and fiber quality.

Nematode and Soil Fertility Analyses

Nematode populations were determined by collecting soil samples at planting, mid-season, and at harvest from each tillage treatment. Soil samples were taken with a modified cone sampler. Ten random soil cores 6 inches deep were combined and mixed from each plot. All parameters were correlated with cotton yield and water residues. A diagnostic soil analysis was completed by the Soil Testing Lab, Mississippi State University, during the fall of each year to determine the effects of best management production practices on soil structure, organic matter, nutrient content, and cation exchange capacity. The soil samples were taken as described previously.

Floristic and Ostracode Surveys

Since the focus of the project was runoff water quality, floristic and ostracode communities in the watershed also were evaluated. An initial survey was conducted to establish baseline data. This data included a floristic listing of species, a listing of sensitive or rare and endangered species, and a comparison of this freshwater mussel community to similar ecosystems. Another environmental parameter monitored was the ostracode population. Ostracodes are microscopic crustaceans sensitive to their aquatic environments that serve as excellent indicators of disturbances in that environment. Samples for both surveys were taken above the project site, at the project site, below the project site, and at the point where Bennett Bayou discharges into Bayou LaFourche. The survey was continued over the two-year test period and compared to baseline data to determine if changes had occurred.

Economic Analysis

An economic analysis was conducted on all data collected to determine the cost effectiveness of each production practice as it related to water quality and non-point source pollutants. Results from field sampling were combined with farm production records and other external information to form a comprehensive data base. This was used in calculating the cost of production for each system. The advantages and disadvantages of the economic impact of the Best Management Practices and cover crops as they relate to the runoff water quality and soil condition were determined by conducting a cost/benefit analysis for each treatment.

Education/ Field Demonstration Days

Demonstrations of the project targeted two distinctive groups: producers/ agri-businesses and the regional citizens/youth. The Quachita Parish Agent for the Louisiana Cooperative Extension Service coordinated the education aspects of the project. Annual producer meetings and tours were established to communicate the project results. Youth tours and education programs were offered at the project location via the 4-H program and Louisiana Educational Systemic Initiate Program. University of Louisiana at Monroe personnel used the project for class tours and demonstrations in the department of Agriculture, Biology, Geo-Science, and Toxicology. Tours also were made available to any organization or class as requested.

Watershed Management

Information from the demonstration project was extended to include the entire watershed. This was accomplished by combining information from watershed examination by project employees with pollutant measurements and the cost/benefit section of the study. Statistical techniques (primarily ANOVA) were then used to forecast the impact of using best management practices over the entire watershed area.

RESULTS AND DISCUSSION

To illustrate the chemical-intensive nature of cotton production, a "Calendar of Events" for the 1997 and 1998 growing seasons is shown in Table 1. Major production events and application of pesticides are shown by date to give the reader a better appreciation of the timing of applications during the growing season. The schedule of operations listed may not be typical of *every* producer but it is certainly typical of *most* production practices throughout the mid-south, especially the Louisiana-Mississippi delta region ***(Editor's Note: This project was conducted prior to the boll weevil eradication program).*** Surprisingly, major events (planting, cultivating, harvesting, etc.) occurred at approximately the same time of year for both seasons even though the two years were not similar in weather patterns. Cool temperatures and frequent rainfall during April and May of 1997 delayed the crop two weeks compared to the time frame for 1998, while the 1998 season was characterized as being extremely hot and dry.

The four management options required different schedules either due to the definition of the treatment, or the insect pest complex present. For example, Options 1 and 2 (conventional tillage, without or with cover crop) normally were the only treatments cultivated. One exception to this was early June '97 when *all* fields were cultivated to alleviate a water-saturated soil condition due to excess rainfall. Options 2 and 4 (cover crop treatments) were treated with herbicide prior to planting as a "burn-down" operation during April of each year. The next week, a residual-type herbicide (Prowl) was applied to all plots but only Treatments 1 and 2 were cultivated. Later in the season, bollworm-budworm control was necessary in the conventional cotton (Options 1, 2, 3) but not in the transgenic variety (Option 4).

A total of 14 different herbicides, insecticides, and defoliant were used over the two-year project period. Herbicides were normally applied early season, while insecticides were applied early, mid- and late season. Defoliant, of course, was the last material applied at the end of each growing season. Table 2 shows the distribution of the applications after each primary stage of production (i.e. preparation/planting, mid-season insect control, late season insect control, etc.).

Table 1. "Calendar of Events" for cotton production, 1997-98 seasons. [1, 2, 3]

Month	**1997**	**1998**
APR	**Roundup** appl to cover crops (Options 2, 4) **4/5-Preplant runoff collected* 4/15-**Prowl** appl to all fields; all fields re-hipped.	4/4- **Roundup** appl to cover crops (Options 2, 4) 4/17- **Prowl** appl broadcast to all fields. Options 1, 2 disked & re-hipped; Options 3, 4 sprayed only. **4/28-Preplant runoff collected*
MAY		5/2- Crop planted after rain event. **Temik/Terraclor Super X** appl in furrow.
	5/15- Crop planted.	5/15- **Orthene** (0.75 lbai/A) appl all fields for thrips control.
	**5/21-Post plant runoff collected*	5/21- **Fusillade DX** (0.1 lbai/A) appl all fields for grass control.
		5/30- Options 1, 2 cultivated.
		5/29-31- All fields irrigated (1000 gal/plot)
JUN		6/1- **Staple** (1.2 oz/A) appl all fields for braodleaf weed control
	**6/5-Early season runoff collected* 6/6- Crop re-planted due to cool temp./high rainfall during May	6/4-10- All fields irrigated (1 plot/12 hr)
	6/13- All fields cultivated to dry soil. **Fusilade DX** (0.1 lbai/A) appl for grass control.	6/6- **Vydate** (0.5 lbai/A) appl all fields for boll weevil control.**Early season runoff collected*
	6/14- **Orthene** (0.1 lbai/A) appl all fields for thrips control.	6/11- Plant mapping of all fields(plant ht/node number).
	6/21- Options 1, 2 cultivated	6/13- **Staple** (1.8 oz/A) appl all fields; Treatments 1, 2 cultivated.
	6/29- **Vydate** (0.5 lbai/A) appl all fields for weevil control.	6/18- **Vydate** (0.5 lbai/A) appl all fields for weevil control.

Month	1997	1998
JUL		7/2- **Methyl** (0.25 lbai/A) appl all fields for weevil control.
	7/5- Treatments 1, 2 cultivated.	
	7/9- **Methyl parathion** (0.25 lbai/A) appl all fields for boll weevil control.	7/9- **Methyl** (see above) appl Option 4 only for weevil control.
	7/16- **Vydate** (0.5 lbai/A) appl all fields for weevil control.	7/15- **Methyl + Karate** (0.25 lbai/A + 3.2 oz/A) appl Option 1 only for weevil-worm control.
		7/20- **Methyl + Karate** (see above) appl Options 1,2,3 for weevil-worm control; **Methyl** (0.25 lbai/A) appl Option 4 for weevil control.
	7/23- **Methyl + Karate** (0.25 lbai/A + 0.18 lbai/A) appl Options 1,2,3 for weevil and bollworm-budworm control.	7/28- **Methyl + Karate** (see above) appl Opotions 1,2,3 for weevil-worm control; **Methyl** (see above) appl Option 4 for weevil control.
	7/30- **Methyl + Karate** (see above) appl Options 1,2,3 for weevil-worm control; **Methyl** (0.25 lbai/A) appl Option 4 for weevil control.	
AUG		8/4- **Methyl + Karate + Provado** (0.25 lbai/A +3.2 oz/A + 3.75 oz/A) appl Options 1,2,3 for weevil-worm-aphid control; **Methyl + Provado** (see above rates) appl Option 4 for weevil-aphid control.
	8/6- **Methyl + Karate** (see above) appl Options 1,2,3 for weevil-worm control; **Methyl** (see above) appl Option 4 for weevil control.	**8/ 8-Mid season runoff collected*
	**8/ 10-Mid season runoff collected*	
	8/13- **Methyl + Karate** (see above) appl Options 1,2,3 for weevil-worm control; **Methyl** (see above) appl Option 4 for weevil control.	8/14- **Methyl + Karate + Larvin** (0.25 lbai/A + 3.2 oz/A + 32 oz/A) appl Options 1,2,3 for weevil-bollworm-beet army worm control; Methyl (0.25 lbai/A) appl Option 4 for weevil control.
		8/15- Irrigation stopped in all fields.
	8/20- **Methyl + Curacron** (0.25 lbai/A + 0.75 lbai/A) appl Options 1,2,3 for weevil, bollworm-budworm control; **Methyl** (0.25 lbai/A) appl Option 4 for weevil control. **Fusilade DX** (0.1 lbai/A) appl all fields for late season grass control.	8/18- **Methyl + Curacron + Larvin** (0.25 lbai/A + 0.75 lbai/A + 32 oz/A) appl Options 1,2,3 for weevil-bollworm-army worm control; **Methyl + Larvin** (0.25 lbai/A + 32 oz/A) appl Option 4 for weevil-army worm control.
	8/27- **Methyl + Curacron** (see above) appl Options 1,2,3 for weevil-worm control; **Methyl** (0.25 lbai/A) appl Option 4 for weevil control.	8/24- **Methyl + Curacron + Larvin** (see above) appl Options 1,2,3 for weevil-bollworm-army worm control;

Month	**1997**	**1998**
AUG		8/24- **Methyl** (0.25 lbai/A) appl Opt ion 4 for weevil control.
SEP	9/3- **Methyl + Curacron** (see above) appl Options 1,2,3, for weevil-worm control. 9/11- **Methyl + Curacron** (see above) appl Option 1 only for weevil-worm control. **Methyl** (0.25 lbai/A) appl Option 2,3,4 for weevil control. 9/19- **Methyl** (0.25 lbai/A) appl Options 2,3,4 for weevil control. 9/30- All fields defoliated with **Finish** (2 qt/A); **Methyl** (0.25 lbai/A) added for Option 1.	9/3- **Methyl + Curacron + Larvin** (see above) appl Options 1,2,3 for weevil-bollworm-army worm control; **Methyl + Larvin** (see above) appl Option 4 for weevil-army worm control. **9/13- Late season runoff collected.* 9/15- All fields defoliated with Finish (2 qt/A); Methyl (0.25 lbai/A) added for Option 1 only. 9/22- All fields harvested.
OCT	10/9- All fields harvested. **10/24- Late season runoff collected*	
NOV	**11/29- Winter runoff collected*	**11/15- Winter runoff collected.*

(1) Options: #1 = Conventional tillage
#2 = conventional tillage + cover crop
#3 = Conservation (minimum)tillage
#4 = Conservation tillage + cover crop+ transgenic cotton

(2) Abbreviations: appl = applied; lbai/A = pounds active ingredient per acre; methyl = methyl parathion; temp = temperature; ht = height.

(3) Chemicals:

Brand Name	Common Name
Orthene	Acephate
Temik	Aldicarb
Karate	Cyhalothrin
Finish	Ethephon + Cyclanilide
Fusilade DX	Fluoziflop
Roundup	Glyphosate
Provado	Imidacloprid
Methyl parathion	Methyl parathion
Vydate	Oxamyl
Terraclor Super X	PCNB + Etridiazole
Prowl	Pendimethalin
Staple	Pritiobac sodium
Curacron	Profenofos
Larvin	Thiodicarb

The dates of 30JUN and 15AUG were arbitrarily selected as a means of dividing the production practices into three stages in regards to pesticide application. A total of 16 pesticide applications were made during 1997, and 20 were made in 1998. While Table 2 does not differentiate between simultaneous applications to all plots and selected applications to one or more treatment groups, it does emphasize, like Table 1, the application of chemicals is based on need, rather than calendar date, and will vary somewhat from one year to the next.

Table 2. Distribution of pesticide applications by production practices.

Year	Early	Mid-season	Late Season	Total
1997	3	6	7	16
1998	9	7	4	20

The Quality Assurance Plan submitted with the original proposal described the calculations used to determine a "rainfall event" during this demonstration project. Theoretically, a 0.5" rainfall would provide enough runoff for the automatic samplers to be activated to collect a runoff sample. Table 3 shows the recorded rainfall at the time of each sample collection and the resulting runoff. It can be seen that the runoff varied not only from treatment to treatment during the same rainfall event, but also varied from event to event during the same year. Pre-plant conditions, for example, during the spring of 1997 (4/7/97) resulted in Options 1 (conventional) and 4 (conservation + cover) yielding the same amount of runoff. The next sampling collected that year resulted in all management options having much less runoff than the previous samples. No post-emerge collection was made in 1998 due to insufficient rainfall during that segment of the season. In fact, during one extremely dry period of that year, a rainfall event of 0.9" occurred, but all the water was absorbed by the soil and no runoff was observed (data not shown as no samples were collected).

Applying Analysis of Variance (ANOVA) to the runoff data in Table 3 indicates that there was a significant difference between the management options for the combined two-year data. Conventional tillage with a cover crop (Option 2) was significantly different from conservation tillage with a

Table 3. Rainfall[1] and peak runoff from BMP options.

Stage	**Year**	**Rainfall**	**OPT1**	**OPT2**	**OPT3**	**OPT4**	**Avg[3]**
Pre-	'97	2.03	133[2]	85	75	132	**85.5 ab**
	'98	2.36	85	26	121	27	
Post	'97	2.00	12	11	22	26	--
	'98	--	--	--	--	--	
Early	'97	1.55	5	3	11	13	**23.6 c**
	'98	0.98	44	8	8	90	
Mid-	'97	1.83	10	13	14	21	**37 bc**
	'98	0.45	50	16	11	145	
Late	'97	2.99	26	15	57	53	**90.4 a**
	'98	3.02	62	70	202	227	
Winter	'97	2.67	40	35	118	73	**48.7 abc**
	'98	0.99	42	18	35	53	
	Avg		**51.4 ab**	**29.4 b**	**64.6 ab**	**88.9 a**	

[1] inches on date of rainfall event.
[2] Average of 3 replicates per management option, gallons per minute (gpm).
[3] 2-yr average per rainfall event. Similar letters by values indicate no significance at P= 0.05

cover crop (Option 4) with Option 4 yielding the greater amount of runoff. The two other management practices were 'in-between' the two extremes in peak runoff, and consequently, were not significantly different from either the high or the low peak runoff amount.

This seems to be a contradiction to what was expected, namely, the conservation tillage options producing less runoff because of increased organic matter on the ground. A look at Table 3 reveals that the discrepancy appears at mid- and late season sampling in 1998. These two sampling times showed a high runoff for Option 4 (145 and 227 gpm) and also Option 3 for the '98 late sample (202 gpm). One explanation for this could be that the soils in the conservation tillage fields had become "sealed over" by formation of a surface crust as a result of irrigation with no tillage through mid-August of that year. However, no attempt was made to verify this theory at the time.

A significant difference also was noted between the various production stages. The 2-year average for late season runoff (90.4 gpm) was the greatest of any of the production stages, while early season runoff (23.6 gpm) was the least. This matches the normal weather patterns in northeastern Louisiana in that heaviest rainfall occurs in late fall, winter, and early spring.

Table 4. Total suspended solids (TSS) in runoff water.

Stage	Year	Opt1	Opt2	Opt3	Opt4	2yr Avg*
Pre-plant	'97	357**	200	161	167	**748 ab**
	'98	2368	1411	524	668	
Post	'97	667	1035	1015	610	--
	'98	--	--	--	--	
Early	'97	801	1811	1103	454	**1130 a**
	'98	--	2395	677	472	
Mid	'97	--	1042	841	562	**1059 a**
	'98	2937	1495	880	196	
Late	'97	800	2226	1017	505	**573 ab**
	'98	305	211	91	103	
Winter	'97	592	414	--	59	**309 b**
	'98	511	415	37	89	
Avg/Opt		**1005 a**	**1037 a**	**632 ab**	**334 b**	

*2-yr average per rainfall event. Similar letters by values indicate no significant difference at P= 0.05.

**Average of 3 replicates per management option, mg/L.

Even though the conservation tillage options yielded the greatest *amount* of runoff, other parameters examined during this project show that the *quality* of the runoff was improved (less pollution) by the use of BMPs. The concentration of total suspended solids (TSS) as shown in Table 4 illustrates this point quite well. As can be seen, Options 1 and 2 (conventional tillage practices) had significantly higher levels of suspended solids, primarily as silt, than did conservation tillage with cover crop (Option 4), even though this practice had the greatest peak runoff (refer to Table 3). Conservation tillage alone (Option 3) proved to be not significantly different from the two extreme values. Again, there was a significant difference between rainfall events during the growing season. Early and mid-season cultivation practices, especially for Options 1 and 2, produced runoff with a high concentration of suspended solids. Winter stage of production yielded the lowest amount of solids in the runoff for all options.

Volatile solids (VS), shown in Table 5, represent the organic matter found in the runoff. The data obtained from measuring volatile solids was similar to TSS, i.e., a significant difference occurred between Option 4 and Options 1 and 2, and between Winter and Early-to-Mid-season stages of growth.

Table 5. Volatile solids (VS) found in cotton runoff water.

Stage	Year	Opt1	Opt2	Opt3	Opt4	2yr Avg*
Pre-	'97	29**	28	26	35	**80 b**
	'98	265	146	51	42	
Post	'97	100	140	128	81	--
	'98	--	--	--	--	
Early	'97	75	155	101	54	**112 ab**
	'98	--	265	89	77	
Mid-	'97	--	281	229	41	**160 a**
	'98	250	200	122	29	
Late	'97	126	225	187	60	**64 b**
	'98	23	22	18	17	
Winter	'97	126	109	--	21	**54 b**
	'98	57	55	9	20	
Avg/Opt		**115 a**	**131 a**	**86 ab**	**40 b**	

*2-yr average per rainfall event. Similar letters by values indicate no significant difference at P= 0.5.
**Average of 3 replications per management option, mg/L.

Total Kjeldahl Nitrogen (TKN) is a widely used parameter for determining water quality that represents the sum of organic nitrogen compounds, such as proteins and peptides, urea and nucleic acids, and numerous synthetic compounds, plus inorganic ammonia nitrogen. Table 6 illustrates that BMPs, especially conservation tillage plus a cover crop (Option 4), can significantly reduce the amount of TKN in runoff water. As can be seen, Option 4 produced the least concentration of TKN of any of the four treatments used during the project. The other three options were not significantly different from each other, even though Option 1 showed the highest average amount. Likewise, early season activities produced the greatest amount of runoff TKN, while pre-plant, mid-to-late, and winter stages of production showed significantly decreasing levels of TKN.

Table 6. Total Kjeldahl Nitrogen (TKN) in cotton runoff water.

Stage	Year	Opt1	Opt2	Opt3	Opt4	2yr Avg*
Pre-	'97	2.16**	2.21	2.31	2.11	**8.39 b**
	'98	14.74	13.43	14.17	14.07	
Post	'97	4.67	7.05	5.78	6.0	--
	'98	--	--	--	--	
Early	'97	32.08	35.21	33.22	28.14	**27.04 a**
	'98	--	13.62	11.64	12.02	
Mid-	'97	--	3.15	3.53	2.56	**4.77 c**
	'98	8.78	4.06	6.77	6.38	
Late	'97	3.08	3.49	3.82	3.36	**4.08 c**
	'98	4.50	5.18	4.63	4.05	
Winter	'97	5.96	4.77	--	4.42	**2.32 d**
	'98	1.07	0.95	0.75	0.54	
Avg/Opt		**9.11 a**	**8.93 a**	**8.76 a**	**6.15 b**	

*2-yr average per rainfall event. Similar letters by values indicate no significant difference at P= 0.05.
**Average of 3 replications per management option, mg/L.

Phosphorus (as PO_4=) occurs in natural waters and wastewaters as orthophosphate, condensed phosphate (pyro- meta- and polyphosphates), and organically bound forms. Orthophosphates applied to agricultural or residential lands as fertilizer are carried into surface waters with storm runoff and to some extent with melting snow. Table 7 shows the phosphate concentrations found in the runoff water from the different management options used.

It can be seen that the average value for $PO_4^{=}$ runoff was significantly higher from Option 1 fields than the other options (2.63 mg/L compared to 1.24 -1.79 mg/L). Likewise, the stage of production plays a role in phosphate concentration. Early season operations significantly increased the phosphate concentration in the runoff waters over the other stages of growth.

Table 7. Phosphate concentration in runoff water.

Stage	Year	Opt1	Opt2	Opt3	Opt4	2yr Avg*
Pre-plant	'97	0.55**	0.55	0.56	0.64	**0.88 b**
	'98	1.90	1.33	0.67	0.75	
Post	'97	0.92	0.97	0.99	0.86	--
	'98	--	--	--	--	
Early	'97	10.67	7.09	7.10	6.58	**6.21 a**
	'98	--	2.15	1.05	1.53	
Mid-	'97	--	0.80	0.72	0.63	**1.77 b**
	'98	4.52	2.42	1.61	2.09	
Late	'97	1.45	1.29	1.56	1.20	**1.26 b**
	'98	1.26	1.08	1.17	1.18	
Winter	'97	1.15	0.86	--	0.99	**0.78 b**
	'98	0.65	0.77	0.55	0.62	
Avg/Opt		**2.63 a**	**1.79 b**	**1.66 b**	**1.24 b**	

*2-yr average per rainfall event. Similar letters by values indicate no significant difference at P= 0.05.
**Average of 3 replications per management option, mg/L.

Ammonia, or the ammonium ion, is naturally present in surface water and wastewaters. Its concentration is generally low in groundwater since it adsorbs to clay particles and is not readily leached from soils. Tillage practices, then, that cause the loss of topsoil should influence the ammonium content of runoff water. However, in this demonstration project, there was no significant difference between the four management options (see Table 8). There was a significant difference between production stages, with higher concentrations of ammonium ion present in the runoff during early production but decreasing amounts as the season progressed. This would coincide with the use of applied nitrogen by the cotton plants. Most of the available nitrogen has been used by the plants by late season.

Table 8. Ammonium ion levels in runoff waters.

Stage	Year	Opt1	Opt2	Opt3	Opt4	2yr Avg*
Pre-plant	'97	0.82**	1.10	1.15	1.32	**2.50 a**
	'98	4.00	3.80	3.47	3.73	
Post	'97	2.40	3.30	2.70	3.30	--
	'98	--	--	--	--	
Early	'97	1.80	2.10	1.90	1.80	**2.49 a**
	'98	--	3.00	4.60	3.40	
Mid-	'97	--	1.50	1.20	0.92	**2.73 a**
	'98	7.17	4.32	2.62	2.34	
Late	'97	1.97	2.00	1.85	1.90	**1.66 b**
	'98	1.58	1.55	1.37	1.32	
Winter	'97	1.65	1.2	--	1.25	**0.79 c**
	'98	0.45	0.56	0.44	0.47	
Avg/Opt		**2.33 a**	**2.16 a**	**2.09 a**	**1.96 a**	

*2-yr average per rainfall event. Similar letters by values indicate no significant difference at P= 0.05.
**Average of 3 replications per management option, mg/L.

Nitrate-nitrogen (NO_3^-), in contrast to TKN and NH_4^+, is a highly mobile form of nitrogen noted for its ability to leach from soils. It is a product of microbial oxidation of ammonium and, therefore, should be influenced by the amount of ammonium applied and not by tillage practices. The previous parameters discussed generally show Option 1 being significantly different from Option 4. However, in this demonstration project, Option 3 resulted in a higher level of nitrate in the runoff (see Table 9). Conventional tillage practices were not different from conservation tillage plus cover crop.

Editor's Note: Table 9 also shows a 10-fold increase in nitrate levels at pre-plant stage of production between the 1997 and 1998 seasons. Apparently wet soils during 1997 inhibited nitrification since the same amount of nitrogen was added each year.

Table 9. Nitrate-N in runoff from cotton BMPs.

Stage	Year	Opt1	Opt2	Opt3	Opt4	2yr Avg*
Pre-plant	'97	0.44**	0.40	0.47	0.51	**23.67 b**
	'98	43.3	41.3	44.0	43.3	
Post	'97	2.13	2.67	2.4	2.2	--
	'98	--	--	--	--	
Early	'97	22.7	21.0	24.7	22	**27.57 a**
	'98	--	32.0	47.5	32.0	
Mid-	'97	--	1.25	1.43	1.5	**5.43 c**
	'98	5.65	9.0	9.8	9.4	
Late	'97	1.00	1.25	1.10	1.20	**1.44 d**
	'98	1.73	2.00	1.50	1.47	
Winter	'97	1.20	1.20	--	1.35	**1.15 d**
	'98	1.03	1.27	0.95	1.08	
Avg/Opt		**9.99 b**	**9.75 b**	**13.16 a**	**9.08 b**	

***2-yr average per rainfall event. Similar letters by values indicate no significant difference at P= 0.05.**
****Average of 3 replications per management option, mg/L.**

The nitrate levels did vary considerably from one production stage to another regardless of the management option used. Nitrate concentrations in the runoff, like that of ammonium, TKN, and phosphate, increased from pre-plant to early stage of growth, but then decreased to lowest level by late season and winter period which would follow the crop's use of nutrients through the growing season.

The pH values of the runoff samples are shown in Table 10. Option 4 produced the highest pH (6.1) while Option 2 resulted in the lowest pH value (5.7) for the two-year period. The 1997 average for all options (pH = 5.46) was significantly different from the '98 overall average (pH = 6.5), however, soil samples collected during the early spring of 1998 did not indicate any need for the addition of lime for pH correction.

Table 11 shows how the pH of the runoff is influenced by nutrient production by soil microorganisms and use of these nutrients by the crop. As can be seen, when nitrate and phosphate levels are highest (early stage of production), the pH of the runoff is low. When these nutrients decrease from crop usage, the pH level rises

Table 10. Changes in runoff water pH.

Stage	Year	Opt1	Opt2	Opt3	Opt4	2yr Avg*
Pre-plant	'97	5.9**	5.7	5.3	5.3	**5.98 ab**
	'98	6.2	6.4	6.5	6.5	
Post	'97	4.9	4.8	5.0	5.0	--
	'98	--	--	--	--	
Early	'97	5.4	5.4	5.4	5.5	**5.74 b**
	'98	--	6.6	6.5	6.7	
Mid-	'97	--	5.3	5.4	5.4	**6.3 a**
	'98	6.9	7.0	7.0	7.1	
Late	'97	5.1	5.2	5.8	6.3	**6.01 b**
	'98	6.4	6.4	6.2	6.3	
Winter	'97	5.5	5.6	--	6.3	**6.15 ab**
	'98	6.7	6.9	7.0	7.0	
Avg/Opt		**5.9 ab**	**5.7 b**	**5.9 ab**	**6.1 a**	

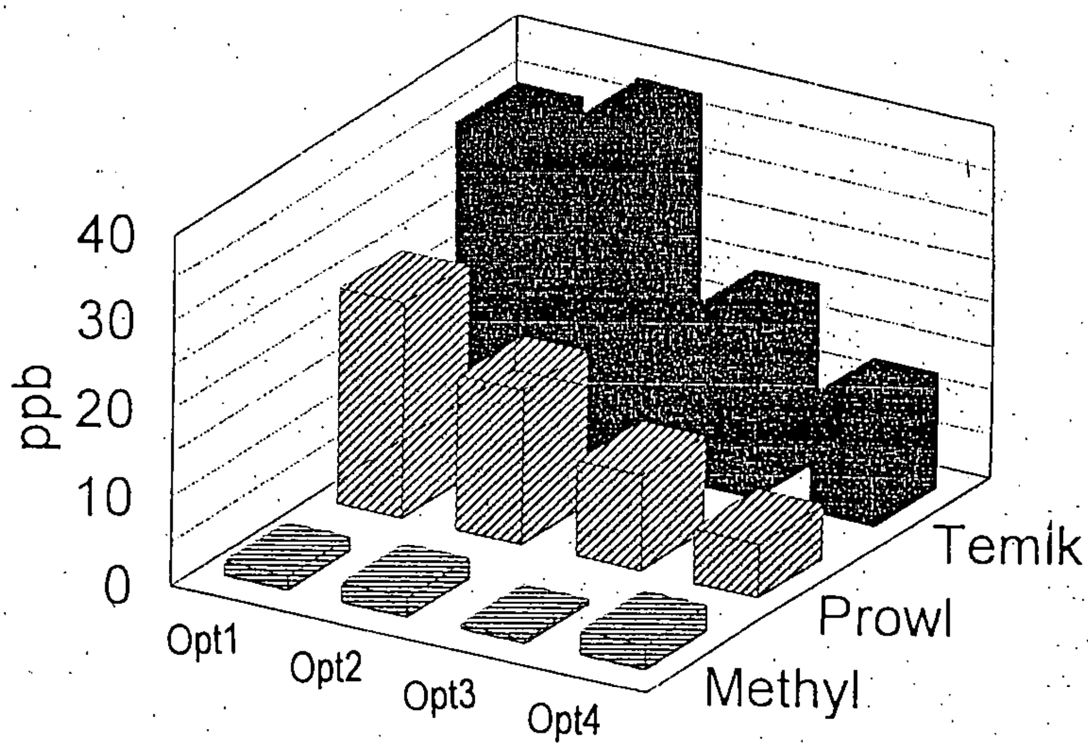
*2-yr average per rainfall event. Similar letters by values indicates no significant difference at P= 0.05.
**Average of 3 replications per management option, pH units.

Table 11. Influence of nutrient use by cotton on pH of runoff.

Stage	pH	NO3 (mg/L)	PO4 (mg/L)
Pre-plant	5.98	23.67	0.88
Early	5.74	27.57	6.21
Mid-	6.3	5.43	1.77
Late	6.01	1.44	1.26
Winter	6.15	1.15	0.78

Another example of the effectiveness of conservation tillage is seen in Figure 1. Three pesticides, Temik*, Prowl* and Methyl parathion were selected from the list of pesticides used (see Appendix B, Runoff Water Analysis, for complete results). The data shown is the maximum amount recovered on any one sampling date during the 1997 growing season. Temik*, a soil-applied nematocide/insecticide, and Prowl*, a soil-applied herbicide, are both used prior to or at planting. Cultivation practices that disturb the soil (conventional tillage) allow more of these pesticides to be removed by surface runoff than do operations that disturb only a fraction of the soil surface (conservation tillage). Temik*, for example, was detected in the runoff samples at concentrations of 35.3 and 38.7 parts per billion (ppb) from Options 1 and 2 respectively, but was 45-64% lower in Options 3 and 4 (20.2 ppb and 13.2 ppb). Prowl* was found in decreasing amounts from one option to another. Option 1 produced the highest concentration in the runoff water (24.4 ppb), with Options 2 (cover crop used), 3 and 4 (conservation + cover crop) yielding values of 17.5, 10.8, and 6.1 ppb. Methyl parathion, a foliar-applied insecticide, was found to be in greatest concentration from the options that had more applied to them for insect control, hence, no correlation to soil disturbing operations.

Fig. 1. Pesticides detected.



Of course, no matter how good best management practices may be in reducing unwanted erosion and/or contamination of a receiving stream, if the practices do not produce an equivalent yield or cost significantly less than conventional operations, no one will use them. Figure 2 illustrates the results of plant mapping during the 1998 season ('97 data not shown but is similar). Plant height was greater for Options 3 and 4, but the number of nodes per plant was essentially the same.

Fig. 2. Plant height & nodes per plant.

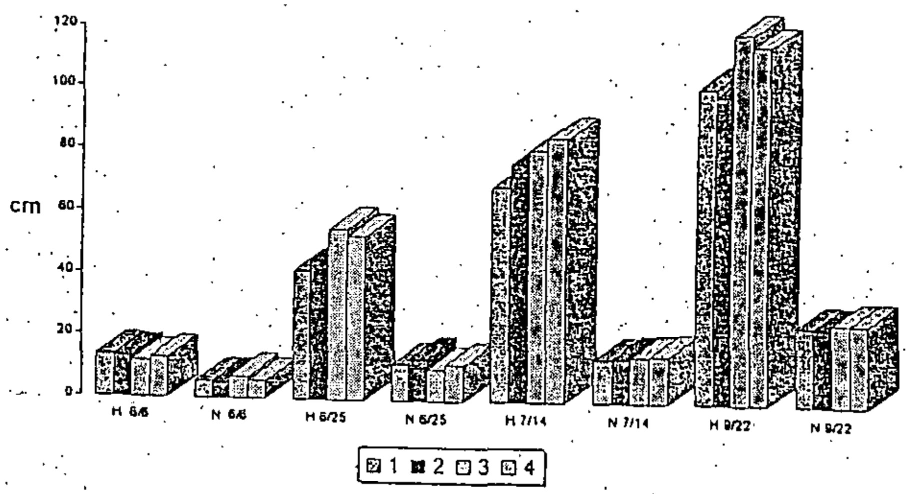


Figure 3 shows the yields of lint cotton for both years. In 1997, the yields ranged from a low of 1,019 lbs/A (Option 1) to a high of 1,477 lbs/A for Option 4. Tthe '98 yield ranged from 751 lbs/A for Option 1 to 861 lbs/A for Option 3. It is apparent that the use of cover crops prior to the '97 season increased yield on both Options 2 and 4. However, the same cannot be said for the '98 season. Extremely hot, dry temperatures during 1998 reduced yield in all treatments compared to the '97 crop. One fact is apparent though, i.e., conservation tillage, with or without a cover crop did NOT adversely affect yields.

Fig. 3. Cotton yields from BMPs.

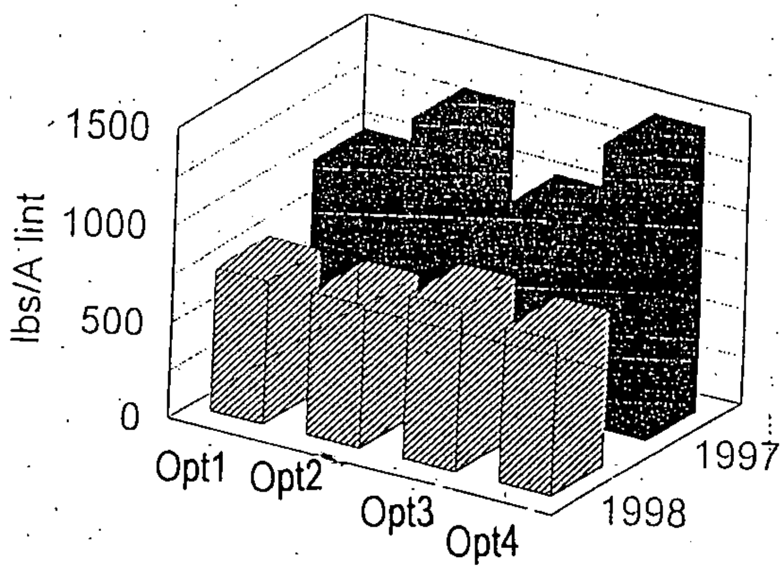


Table 12 gives the economic analysis of the best management practices used in this study. The cost values are displayed as seed/fees, pesticides, and other costs per acre (including fertilizer). The income amounts shown include monies received for cotton lint and cotton seed minus cotton check-off of $2.12 per bale (Appendix C gives complete breakdown of costs and income). Total production costs per acre during the '97 season varied by only $42.31 between the most (Option 2) and least expensive management options (Option 4). Differences in yields, though, accounted for the greater range of net returns (Option 4 = $350.52, Option 1= $6.31). Net income for '98 was negative for all treatments. Conservation tillage options (3 and 4) still showed less monetary loss than did the conventional practices. It should be noted that the use of the transgenic cotton (Option 4) resulted in lower total pesticide costs in each year than the other three treatments. It can be speculated that the use of a standard variety still would have resulted in more net income than the other three due to increased yields (cover crop effect perhaps?).

Table 12. Economic analysis of best management practices.

Item*	Year	Opt1	Opt2	Opt3	Opt4
S/F	'97	$9.84	9.84	9.84	44.60**
	'98	9.84	9.84	9.84	44.60
Pest.	'97	193.59	192.01	192.01	103.63
	'98	208.43	162.36	168.46	128.00
Other	'97	516.58	548.66	518.14	559.97
	'98	492.34	506.30	515.54	493.27
Cost	**'97**	**$720.01**	**750.51**	**719.99**	**708.20**
	'98	**710.61**	**678.50**	**693.84**	**665.87**
Yield,***	'97	1019	1352	1036	1477
Lbs lint/A	'98	751	753	861	817
Income	'97	$726.32	963.98	738.72	1058.72
	'98	540.51	541.93	619.57	588.00
Returns	**'97**	**$6.31**	**213.47**	**18.73**	**350.52**
	'98	**-170.10**	**-136.67**	**-74.27**	**-77.87**
2-YR AVG.		***-163.79***	***76.80***	***-98.20***	***272.65***

*S/F = seed/feed costs/A; Pest. = pesticide cost/A; Costs = total costs/A.
**Opotion 4 is a transgenic cotton.
*** Yield in lbs lint cotton/A.

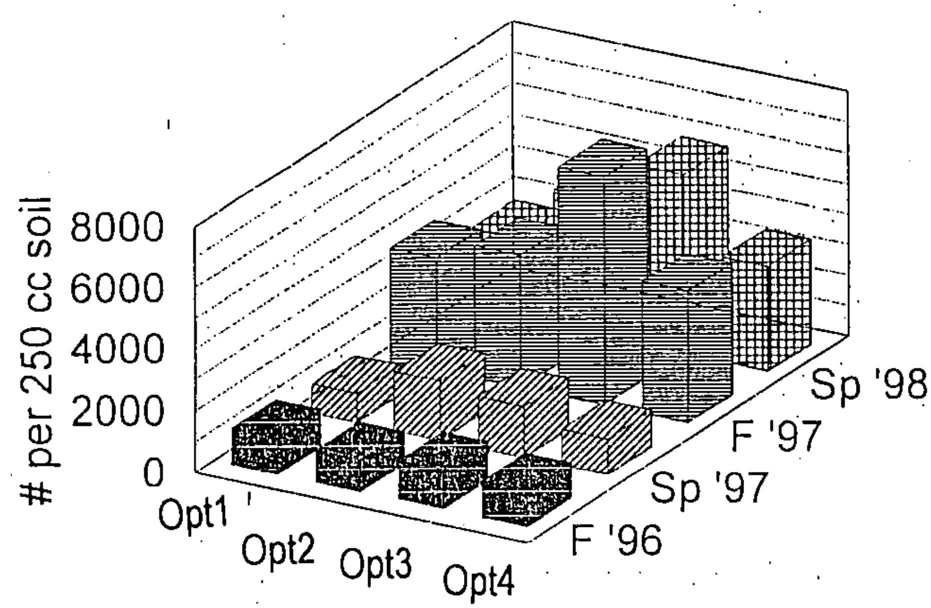
Late season insecticide costs during the 1997 season increased production costs of the non-transgenic cotton (Options 1, 2, 3) by $88-89/A. This extra cost for bollworm-budworm control more than offset the $32.00/A "technology fee" paid to the seed company for the transgenic variety. Overall production costs were lower in '98 than the previous year. The technology fee for transgenic seed would have been exceeded by only Option 1 in 1998. The per acre costs for Options 2 and 3 were only $12.63 and $27.97 more than for Option 4.

The findings from this study were presented to the public during field-demonstration days held during the month of August in both 1997 and 1998. Approximately 150 people attended the 1997 field day and 80 attended the 1998 date (personal communication with Dr. John Barnett, Cotton Production Specialist, Louisiana Agriculture Center). The BMP plots were part of the

Ouachita/Richland Parish Cotton Demonstration Tour conducted jointly by the LSU Agricultural Center Cooperative Extension Service (Ouachita and Richland Offices), University of Louisiana-Monroe, and the Louisiana Cotton Producers Association. Topics covered at the field days included yield and cost data, demonstration of sampling techniques, and results of runoff analysis (see Appendix F for brochure). A second method of publicizing the results of this study was the presentation of data at the Louisiana Academy of Sciences meeting, February 1998. A copy of the abstract is included in Appendix F.

Environmental considerations of the BMPs on the watershed area also were considered in this study. Such factors as the effect on soil nematodes, changes in the floristic and ostracode populations of the receiving stream, and initial water quality play an important role in determining the overall effect of any management strategy employed to improve surface water runoff. Figure 4 illustrates what effect the BMPs had on the nematode population in the test plots. The individual populations increased in each treatment with time, but Option 3 shows the greatest increase, especially during the second year of the study. Average values for the four sampling periods are Opt1 = 2143, Opt2 = 2951, Opt3 = 4081, and Opt4 = 2516. The Option 3 average is almost double that of the others. Perhaps one conclusion that can be drawn from the data is that somehow cultivation and/or cover crops provide a more hostile environment for the free-living nematodes than does conservation tillage alone.

Fig. 4. Free-living nematodes.



What effect do the BMPs have on the natural flora of receiving streams? To answer this four locations were established along Bennett Bayou and a floristic survey conducted quarterly during the entire study period. The locations were farthest upstream from the BMP site (L1), just upstream from the site (L2), just below the test site (L3), and farthest downstream from the test area (L4). Table 13 reveals the type of information gleaned from the floristic surveys. Two specific quarters are shown which are representative of the sample results. A cumulative total of 93 species (71 herbaceous, 22 woody) were found. Location 3 (just below the test site) had a total of 45 species, followed by L1 with 43. Locations 2 and 4 each had 38 species recorded at these sites (see Appendix E for complete plant list). Not shown in Table 13 is that L3 also had the most herbaceous species with a total of 38, while L2 had the least number of herbaceous types (29). Locations 1 and 4 each yielded 31 species of herbaceous plants. Location 1 had the most woody plant types (12), L2 had 9 species, and L3 and L4 each had 7 species. Overall, L3 showed the greatest plant diversity while L2 showed the least. Nine species were recorded at all locations, 10 species were found in three of the locations, 23 found at two locations, and 51 species were found at only one of the locations along the bayou. To answer the initial question "what effect do the BMPs have on the natural flora of the receiving stream?". Apparently, they have little or no adverse effect.

Table 13. Plant survey of Bennett Bayou (# species found).

Date	L1*	L2	L3	L4
May '97	41	35	45	36
Aug '98	43	38	45	38

*L1, farthest upstream; L2, just above BMPs; L3, just below BMPs; L4, farthest downstream.

Table 14 lists the ostracodes (microscopic crustaceans) which were found in Bennett Bayou before and after the BMP project commenced. Since the ostracodes are sensitive to changes in their aquatic environment, they make excellent indicator organisms. The species shown in Table 8 are typical of shallow-dwelling, freshwater ostracodes, commonly found in less than 1 meter of water. They are common to warm areas where temperatures are higher than 22 °C. They also occur where the salinity is low, i.e., less than two parts per thousand (<2 ‰). They are most often found where the pH is more than pH 6.7 and there is low lead and iron content. In other words, the ostracodes found in Bennett Bayou before and after BMPs comprise a normal freshwater community.

Table 14. Ostracodes found in Bennett Bayou.

Species	June '96	June '97
Candon compressa		+
Cypria maculata	+	
Cypridopsis okeechobeensis	+	
Cypridopsis vidua		+
Cyprinotus incongruens	+	
Physocypria pustulosa	+	

In developing a watershed management plan for Bennett Bayou, one needs to consider not only the information gained from this study on best management practices for cotton production, but also several other factors. Average yearly rainfall, seasonal rainfall, 100-year storm duration and quantity, watershed soil type(s), topography of the land, runoff potential, and land use(s) must be considered to develop a truley comprehensive plan. If all the moisture received by an area came from snowpack during Dec-Mar, and the melted snow flowed over rock to the ocean, the water would probably have little or no suspended solids, organic matter, nutrients, or pesticides. It would be cool, clear water. But this is not this case with the Bennett Bayou watershed.

Fig.5. Watershed land use.

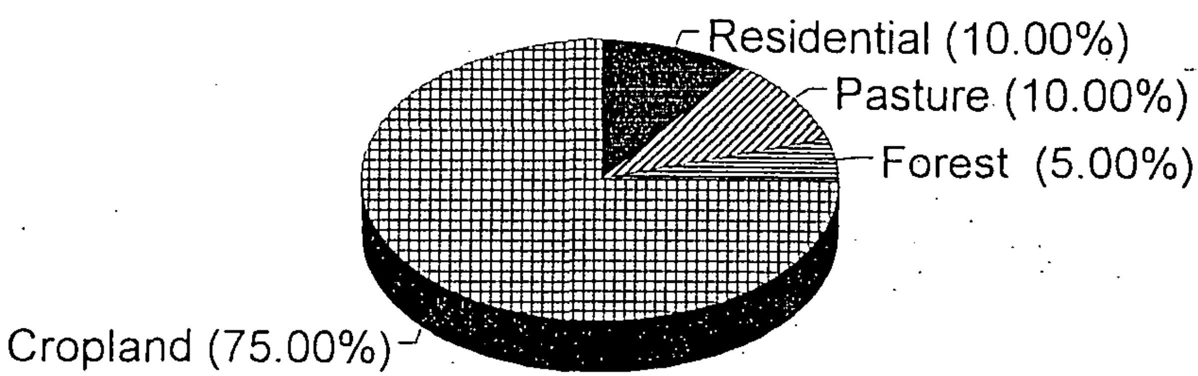


Figure 5 illustrates the estimated land use for the watershed. The farmland use (75% of the total) in the area was primarily for cotton production during the duration of this study. It is obvious that the quality of the runoff water into Bennett Bayou will be greatly effected by the farming operations in the watershed. Residential influence, at this time, would be considered minimal due to the greater proportion of the area in crops. ***(Editor's note: Cotton farming on the Killoden Plantation has been replaced by a Louisiana Department of Agriculture tree nursery since the project was completed)***

The Soil Survey of Ouachita Parish, 1974, conducted by the USDA's Natural Resources Conservation Service (formerly, Soil Conservation Service) in cooperation with the Louisiana Cooperative Extension Service shows that most of the soil types in the area are classified as Hebert silt loam complex (He) and Perry clay (Pe). Hebert complex soils are nearly level and loamy throughout. Some areas of this type are somewhat poorly drained and occasionally flooded. Perry clay soils also tend to be a poorly drained, low permeability soil. Soils of these classes will have a hydrologic potential of moderate to slow infiltration rate, i.e., a moderate to high runoff potential. It is estimated that runoff could be as much as 0.5" after a 2.0" rainfall (Nathanson, JR, Basic Environmental Technology, 2nd ed.), depending upon the soil condition prior to rainfall (dry, saturated, etc.).

Table 15 establishes the projected reductions in suspended solids and pesticides if the best management practice of conservation tillage plus a cover crop was adopted for the farmland portion of the watershed. As stated previously, a significant difference between the management options in *amount of runoff* was found in this study, but what is more important is that a significant difference in *water quality*, as measured by a reduction in TSS, volatile solids, TKN, phosphates, ammonium, pH, and soil-applied pesticides, was observed.

Best management practices for cotton production would have no effect on runoff from residential, pasture, or forests. Since LDEQ previously established that the suspected sources of water pollution include pesticides, priority organics, nutrients, low DO, suspended solids, and turbidity, it is doubtful that the land use areas other than cropland are contributing much to overall pollution of the watershed. Nutrients and pesticides are recognized as contaminates from residential areas in urban watersheds, but this is where residential land use is the greatest proportion. Therefore, it is estimated that the BMP described would result in approximately 65-67% reduction of suspended solids and 45-60% reduction in pesticides in the watershed runoff.

Table 15. Projected % reduction in runoff after adopting BMPs.

Land Use	in Volume	in TSS	in Pesticides*
Residential	0	0	0
Forest	0	0	0
Pasture	0	0	0
Cropland**	**0**	**67**	**45-60**

*Soil-applied pesticides only.
**Cotton production.

SUMMARY

Four cotton production scenarios, a control and three best management practices (BMPs), were compared in a two-year demonstration project as to their effect on runoff water quality in the Bennett Bayou watershed of Ouachita Parish, Louisiana. The project was conducted during the 1997 and 1998 growing seasons.

The four management options consisted of:

a) Opt1, conventional tillage practices, including nutrient and pesticide management, (which served as the control);
b) Opt2, conventional tillage, plus a winter cover crop.
c) Opt3, conservation tillage with nutrient and pesticide management;
d) Opt4, conservation tillage, plus a cover crop and a transgenic variety of cotton.

The treatment plots were arranged in a randomized block design with three replications. Runoff samples were collected after selected rain events during each major production practice from planting to harvest, i.e., pre-plant, post-plant, early, mid-, and late season operations, and at mid-winter. The parameters for the rain events were

a) at least 0.5" rainfall, but
b) less than 3.5" within a 1-hour duration.

These restrictions allowed for a long duration, low intensity rainfall and a short duration, high intensity event, both of which occur during the spring and summer seasons.

The amount of runoff water was recorded as gallons per minute (gpm) peak discharge. The runoff samples were tested for ammonia nitrogen, nitrate-N, nitrite-N, total Kjeldahl-N, total phosphorus, total suspended solids, volatile suspended solids, pH, and priority pesticides used during the growing season.

A significant difference was observed between the BMPs in regards to *amount of runoff*, with Opt4 producing the greatest amount. The increased runoff for this management option was due in part to excessive runoff following periods of irrigation during the mid- to late production stages in the summer of 1998. However, *runoff quality* was found to be significantly better in Opt4 as determined by reductions in total suspended solids (TSS), volatile solids (VS), total Kjeldahl Nitrogen (TKN), phosphate concentration (PO_4=), and soil applied pesticides as compared to the other options. There was no significant difference between the options in regards to the ammonium ion (NH_4+) or nitrate-N (NO_3-) concentrations in the runoff waters.

A significant difference also was observed between *production events* (pre-planting, post-planting, etc.) for all management options in the amounts of peak runoff, TSS, VS, TKN, $PO_4=$, NH_4+, NO_3- concentrations, and pH of the runoff waters.

Cotton yield from the various options produced 2-year averages of 885 lbs/A lint cotton for Opt1, 1052 lbs for Opt2, 948 lbs for Opt3, and 1147 lbs/A for Opt4. During 1997, the difference in production between the highest and lowest yields was 458 lbs/A, while '98 production difference was only 66 lbs/A.

Economic analysis of the four options showed that each had a positive return during the 1997 season, but there was a significant difference between the two treatments with cover crops (Opt4, conservation + cover @ $350.52/A; Opt2, conventional + cover @ $213.47/A) and the two options without winter cover crop (Opt1, control @ $6.31/A; Opt3, conservation alone @ $18.73/A). During the 1998 season, each treatment resulted in a negative profit. The two conservation tillage treatments lost less than the two conventional operations (Opt1 @ -$170.10/A; Opt2 @ -$136.67/A; Opt3 @ -$74.27/A; Opt4 @ -$77.87/A). Considering both years of the test period, conservation tillage plus cover crop produced the greatest profit ($272.65/A).

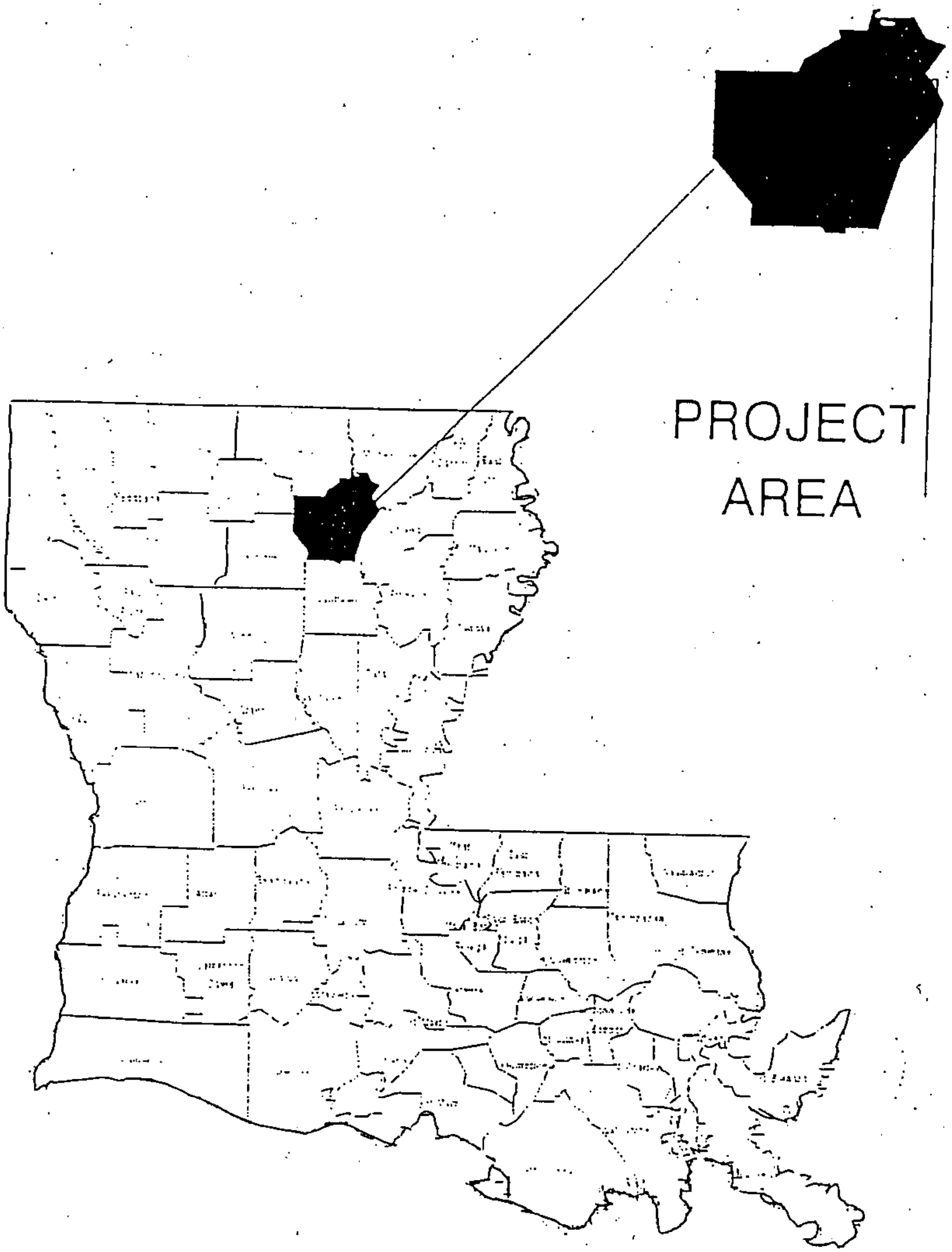
Soil nematode populations fluctuated over the demonstration period from Fall 1996 to Spring 1998. The greatest increase in numbers per 250 cc soil occurred during Fall 1997 and Spring 1998, with Opt3 (conservation tillage alone) yielding the largest amount. The average values were Opt1 = 2143, Opt2 = 2951, Opt3 = 4081, and Opt4 = 2516.

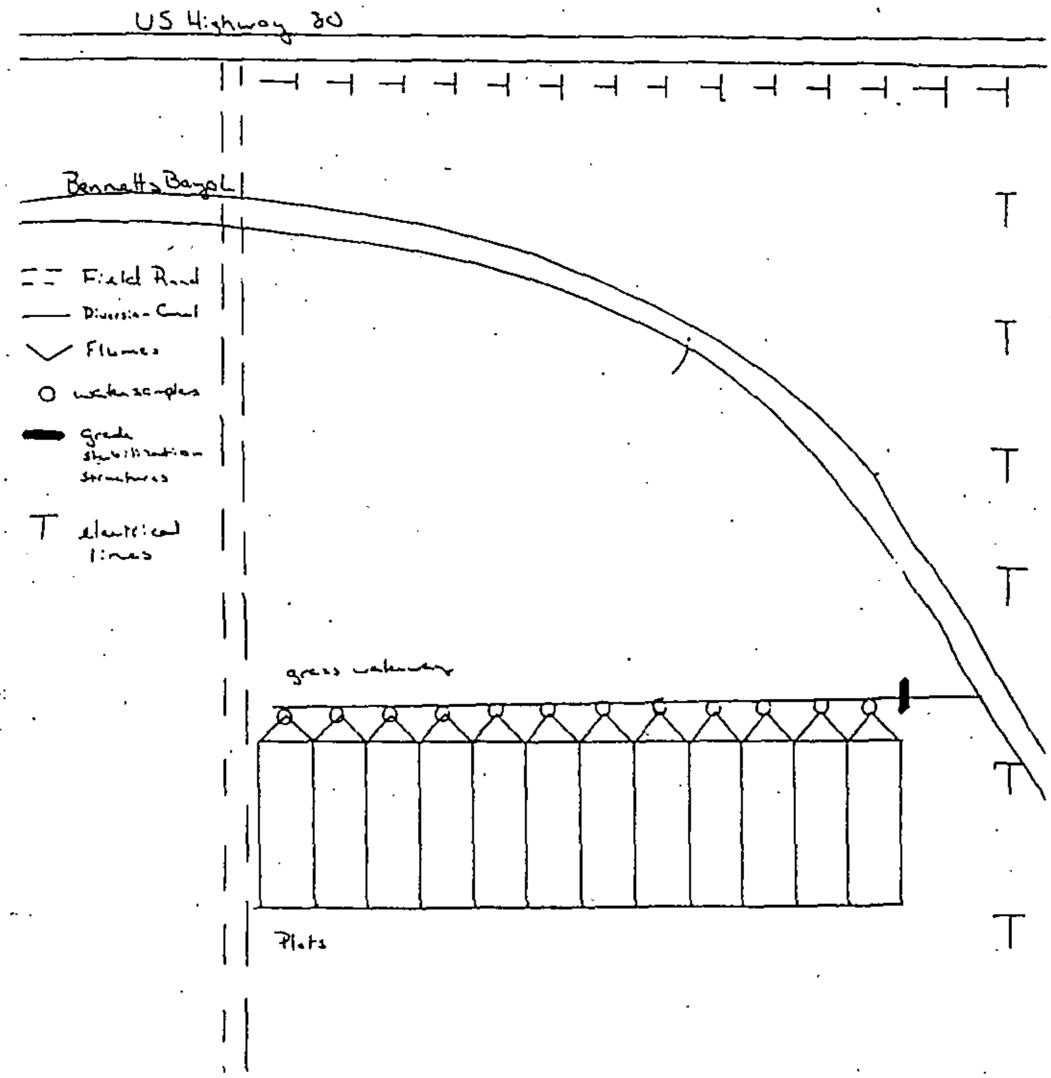
A cumulative total of 93 species of plants (71 herbaceous, 22 woody) were found during the study at four locations along Bennett Bayou (L1 = farthest upstream; L2 = just above BMPs; L3 = just below BMPs; L4 = farthest downstream). The highest number of species was consistently found at location L3, just below the BMP site. This was interpreted to mean the BMPs had no detrimental effect on the bayou flora.

A survey of ostracodes (microscopic crustaceans) was similar to the floristic survey in that the only species found were typical of shallow-dwelling freshwater species, i.e., normal freshwater community.

It is estimated that if the best management practices of conservation tillage plus a winter cover crop were adopted on all the farm land that drains into Bennett Bayou, a 67% reduction in total suspended solids and a 45-60% reduction in soil-applied pesticides would occur within the watershed.

Appendix A: Project Area and Plot Design.


PROJECT
AREA


US Highway 30
Bennetts Bayou
Field Road
Diversion Canal
Flumes
water samples
Grade stabilization structures
electrical lines
grass waterway
Plots

Cotton Runoff Water Quality

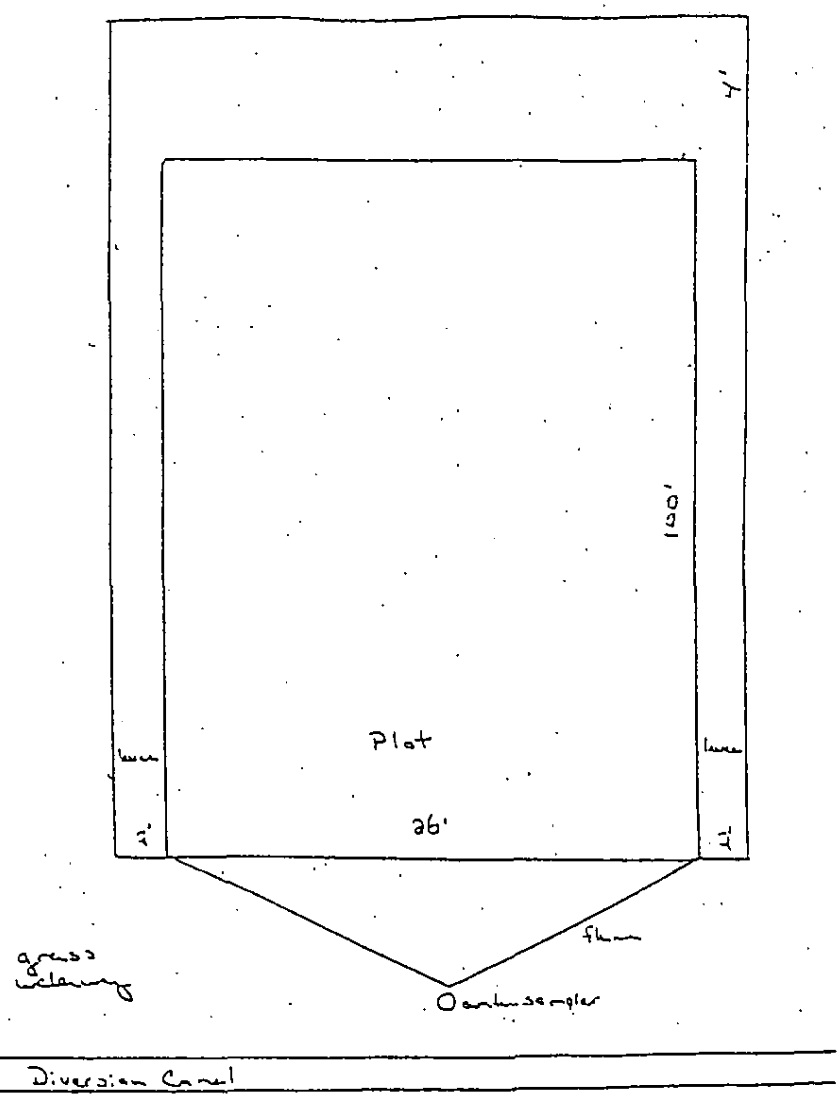
101	102	103	104	202	204	201	203	301	303	304	302
field #1	field #2	field #3	field #4	field #5	field #6	field #7	field #8	field #9	field #10	field #11	field #12

Management Options:

1. Conventional tillage with nutrient and pest management..
2. Conventional tillage as above plus winter cover crop (wheat).
3. Conservation tillage, including nutrient and pest management.
4. Conservation tillage as above plus winter cover crop and transgenic variety of cotton.

Replications:

Option	Code	Field #
1	101	1
	201	7
	301	9
2	102	2
	202	5
	302	12
3	103	3
	203	8
	303	10
4	104	4
	204	6
	304	11



Appendix B: Runoff Water Analysis

Effect of Best Management Practices on Cotton Runoff

Year	Date	Stage	Option	Plot code	Rainfall*	Runoff**	TSS***	VS***	TKN***	PO4***	NH4***	NO3***	pH, units
1997	04.05.97	Pre-plant	Opt1	101	2.03	156	634	34	1.95	0.43	0.8	0.74	6.5
				201	2.03	99							
				301	2.03	144	79	23	2.37	0.67	0.84	0.44	5.2
			Opt2	102	2.03	78	279	26	2.01	0.42	1.17	0.56	6.8
				202	2.03	85	240	25	2.3	0.49	0.99	0.4	5.2
				302	2.03	92	80	32	2.33	0.75	1.14	0.23	5.2
			Opt3	103	2.03	75	59	11	1.78	0.45	0.8	0.7	5.6
				203	2.03	18	340	44	2.77	0.66	1.56	0.4	5.2
				303	2.03	132	83	22	2.37	0.58	1.1	0.3	5.2
			Opt4	104	2.03	54	222	28	1.99	0.51	1.18	0.6	5.3
				204	2.03	215	167	45	2.02	0.54	1.05	0.7	5.3
				304	2.03	126	111	32	2.32	0.88	1.74	0.22	5.2
1997	05.21.97	Post-	Opt1	101	2	9	1288	176	4.67	1.22	2.8	2.4	4.6
				201	2	14	284	48	3.79	0.66	2.4	2.1	4.8
				301	2	14	428	76	5.54	0.87	2	1.9	5.2
			Opt2	102	2	21	648	100	7.28	0.84	3.7	3.5	4.6
				202	2	11	448	96	6.64	0.81	3	2.5	4.9
				302	2	1	2008	224	7.22	1.25	3.1	2	4.9
			Opt3	103	2	22	524	72	5.1	0.9	3	3.2	5
				203	2	18	2128	240	5.61	1.14	2.2	1.8	4.8
				303	2	25	392	72	6.62	0.93	3	2.2	5.1
			Opt4	104	2	35	400	52	3.19	0.72	2.2	2.2	5
				204	2	23	310	44	5.57	0.76	3.9	2.2	5.1
				304	2	20	1120	148	9.24	1.09	3.9	2.2	4.9
1997	06.05.97	Early	Opt1	101	1.55	8	1184	76	30.56	6.29	2.2	28	5.3
				201	1.55	1	836	104	34.32	18.58	1.8	22	5.3
				301	1.55	5	382	44	31.37	7.13	1.5	18	5.7
			Opt2	102	1.55	1	644	100	44.11	8.62	2.3	13	5.4
				202	1.55	3	628	85	20.86	4.27	2	25	5.2
				302	1.55	5	4160	280	40.67	8.39	2	25	5.5
			Opt3	103	1.55	11	2224	184	36.34	6.94	2.3	34	5.2
				203	1.55	2	764	68	25.95	5.62	1.6	18	5.4
				303	1.55	20	320	52	37.36	8.73	1.8	22	5.7
			Opt4	104	1.55								
				204	1.55								
				304	1.55	13	454	54	28.14	6.58	1.8	22	5.5

Year	Date	Stage	Option	Plot code	Rainfall*	Runoff**	TSS***	VS***	TKN***	PO4***	NH4***	NO3***	pH, units
1997	08.10.97	Mid-	Opt1	101	1.83	16							
				201	1.83	3							
				301	1.83								
			Opt2	102	1.83	7	1484	526	3.36	0,69	1.24	1.2	5.1
				202	1.83								
				302	1.83	18	600	35	2.93	0.9	1.83	1.3	5.4
			Opt3	103	1.83	14	1685	663	4.8	0.73	1.34	1.4	5.5
				203	1.83	17	278	10	3.26	0.8	1.13	1.4	5.6
				303	1.83	10	560	15	2.53	0.64	1.1	1.5	5.2
			Opt4	104	1.83	32							
				204	1.83	18	68	38	2.8	0.61	0.88	1.5	5.4
				304	1.83	13	1055	43	2.32	0,65	0.96	1.5	5.3
1997	10.24.97	Late	Opt1	101	2.99	41	651	64	2.57	0,85	2	1.1	5
				201	2.99	14	824	232	3.81	2.51	1.9	1	5.4
				301	2.99	22	924	81	2.87	0.98	2	1	5
			Opt2	102	2.99	13	1882	140	2.8	0,87	1.9	1.2	5.2
				202	2.99	9	2570	310	4.17	1.7	2.1	1.3	5.3
				302	2.99	23							
			Opt3	103	2.99	69	1897	125	3.17	1	1.8	1.2	5.4
				203	2.99	44	137	23	4.46	2.11	1.9	1	6.2
				303	2.99								
			Opt4	104	2.99	48	938	96	4.15	1.03	2.1	1.3	6.3
				204	2.99	54	71	24	2.56	1.37	1.7	1.1	6.4
				304	2.99	58							
1997	11.29.97	Winter	Opt1	101	2.67								
				201	2.67	51	612	136	5.59	1.16	1.8	1.1	5.3
				301	2.67	29	572	116	6.32	1.14	1.5	1.3	5.6
			Opt2	102	2.67	36	368	130	4.59	0.87	1.2	1.1	5.6
				202	2.67	3	460	87	4.94	0.85	1.2	1.3	5.6
				302	2.67	67							
			Opt3	103	2.67	124							
				203	2.67	111							
				303	2.67								
			Opt4	104	2.67								
				204	2.67	59	29	15	3.2	0.62	1.1	1.3	6.3
				304	2.67	86	89	26	5.64	1.35	1.4	1.4	6.3

Year	Date	Stage	Option	Plot code	Rainfall*	Runoff**	TSS***	VS***	TKN***	PO4***	NH4***	NO3***	pH, units
1998	04.28.98	Pre-plant	Opt1	101	2.36	203	4544	496	17.35	2.71	7.2	42	6
				201	2.36	6	1070	110	14.55	1.37	2.5	46	6.6
				301	2.36	47	1490	190	12.32	1.62	2.3	42	6.1
			Opt2	102	2.36	20	1264	128	13.12	1.13	6.4	42	6.3
				202	2.36	42	1970	130	14.87	1.6	3	44	6.3
				302	2.36	15	1000	180	12.31	1.27	2.1	38	6.6
			Opt3	103	2.36	308	246	33	14.16	0.74	4	50	6.4
				203	2.36	50	1220	100	15.74	0.81	3.6	44	6.6
				303	2.36	6	106	19	12.62	0.47	2.8	38	6.5
			Opt4	104	2.36	31	1840	78	12.03	0.68	3.7	44	6.7
				204	2.36	15	105	29	16.24	0.64	3.8	46	6.2
				304	2.36	35	58	20	13.55	0.92	3.7	40	6.5
1998	06.06.98	Early	Opt1	101	0.98	118							
				201	0.98	6							
				301	0.98	7							
			Opt2	102	0.98	4							
				202	0.98	8							
				302	0.98	11	2395	265	13.62	2.15	3	32	6.6
			Opt3	103	0.98	10	390	85	17.09	1.42	6.2	60	6.6
				203	0.98	13	963	92	6.18	0.67	3	35	6.3
				303	0.98	2							
			Opt4	104	0.98	235							
				204	0.98	15							
				304	0.98	21	472	77	12.02	1.53	3.4	32	6.7
1998	08.08.98	Mid-	Opt1	101	0.45	100	5229	400	8.78	2.8	5.34	8.8	6.9
				201	0.45	44							
				301	0.45	7	644	100	9.4	6.24	9	2.52	7
			Opt2	102	0.45	8	1770	250	2.8	3.15	5.36	9	7
				202	0.45	30							
				302	0.45	11	1220	150	5.32	1.68	3.28	9	7
			Opt3	103	0.45	14	380	64	8.1	1.61	2.56	10	7.2
				203	0.45	16	1380	180	5.44	1.62	2.67	9.6	6.8
				303	0.45	2							
			Opt4	104	0.45	279	460	52	6.62	2.04	2.42	9.6	7.4
				204	0.45	10	57	21	6.37	1.85	2.18	9.4	7
				304	0.45	145	71	13	6.15	2.37	2.42	9.2	7

Year	Date	Stage	Option	Plot code	Rainfall*	Runoff**	TSS***	VS***	TKN***	PO4***	NH4***	NO3***	pH, units
1998	09.13.98	Late	Opt1	101	3.02	115	342	27	3.59	1.12	1.39	2.1	6.4
				201	3.02	62	467	21	5.42	1.71	2.12	1.5	6.4
				301	3.02	9	105	22	4.49	0.94	1.23	1.6	6.3
			Opt2	102	3.02	70	68	13	3.57	1.18	1.69	1.5	6.4
				202	3.02	91	256	28	5.01	0.93	1.13	1.5	6.2
				302	3.02	49	310	26	6.96	1.13	1.84	3	6.6
			Opt3	103	3.02	523	43	11	4.97	1.24	1.37	1.4	6.2
				203	3.02	65	144	24	4.29	1.22	1.38	1.6	6.3
				303	3.02	19	86	18	4.64	1.06	1.35	1.5	6.3
			Opt4	104	3.02	444	184	15	3.59	1.06	1.24	1.4	6.4
				204	3.02	185	71	16	3.38	1.08	1.29	1.4	6.2
1998				304	3.02	51	53	21	5.18	1.4	1.42	1.6	6.3
	11.15.98	Winter	Opt1	101	0.99	59	766	44	0.85	0.43	0.5	1.2	6.7
				201	0.99	61	264	62	1.47	0.92	0.42	0.9	6.6
				301	0.99	6	504	66	0.89	0.6	0.44	1	6.9
			Opt2	102	0.99	18	374	58	1.04	0.75	0.62	1.6	6.9
				202	0.99	10	300	44	0.85	0.52	0.62	1.2	6.9
				302	0.99	25	572	62	0.95	1.03	0.44	1	6.9
			Opt3	103	0.99								
				203	0.99	51	26	8	0.77	0.53	0.46	0.94	7
				303	0.99	18	47	10	0.72	0.57	0.42	0.96	7.1
			Opt4	104	0.99	2	44	14	0.88	0.77	0.54	1.4	7.1
				204	0.99	134	112	20	0.57	0.61	0.42	0.9	6.9
				304	0.99	23	112	25	0.68	0.49	0.44	0.9	7

*Rainfall, *total inches* recorded per 24 hr period at Monroe, LA, airport, approximately 1 mile from demonstration site.
**Runoff reported as *peak runoff* during a rainfall event.
***Values shown in mg/L.

Pesticide Summary

07APR97

Pesticide	Conventional	Convent. + cover	Conservation	Conserv. + cover
Trifluralin	ND	ND	ND	ND
Pendimethalin	0.88 ppb	ND	ND	ND
Fluometron	0.01 ppb	ND	ND	ND
Norflurazon	0.96 ppb	ND	0.49 ppb	0.04 ppb
Aldicarb	ND	ND	ND	ND
Methyl Parathion	ND	ND	ND	ND
Malathion	ND	ND	ND	ND
Chlorpyrifos	ND	ND	ND	ND
Metolachlor	ND	ND	ND	ND
Fluazifop-P-butyl	ND	ND	ND	ND
MSMA	ND	ND	ND	ND
Terraclor	ND	MND	ND	ND
Curacron	ND	ND	ND	ND
Thidiazuron	ND	ND	ND	ND
Ethephon	ND	ND	ND	ND

*ND = not detected

WATER SAMPLES SUMMARY
May 2, 1997

	Conventionalt tillage	Conventional IPM, NM, CC	Conservation IPM, NM,	Conservation IPM, NM, CC TC
Trifluralin	NR	NR	NR	NR
Pendimethalin	3.63 ppb	2.03 ppb	3.13 ppb	2.83 ppb
Fluometuron	2.13 ppb	2.50 ppb	1.73 ppb	1.9 ppb
Norflurazon	0.87 ppb	1.00 ppb	2.64 ppb	0.63 ppb
Aldicarb	0.46 ppb	ND	0.90 ppb	1.40 ppb
Methyl Parathion	NR	NR	NR	NR
Malathion	NR	NR	NR	NR
Chlorpyrifos	NR	NR	NR	NR
Metolachlor	NR	NR	NR	NR
Fluazifop-P-butyl	NR	NR	NR	NR
MSMA	NR	NR	NR	NR
Terraclor	NR	NR	NR	NR
Curacon	NR	NR	NR	NR
Thidiazuron	NR	NR	NR	NR
Ethephon	NR	NR	NR	NR

June 18, 1997

	Conventionalt tillage	Conventional IPM, NM, CC	Conservation IPM, NM,	Conservation IPM, NM, CC TC
Trifluralin	NR	NR	NR	NR
Pendimethalin	3.02 ppb	2.96 ppb	3.09 ppb	1.45 ppb
Fluometuron	1.22 ppb	2.76 ppb	1.13 ppb	3.40 ppb
Norflurazon	12.46 ppb	1.44 ppb	3.03 ppb	0.97 ppb
Aldicarb	35.31 ppb	38.73 ppb	20.2 ppb	13.23 ppb
Methyl Parathion	NR	NR	NR	NR
Malathion	NR	NR	NR	NR
Chlorpyrifos	NR	NR	NR	NR
Metolachlor	NR	NR	NR	NR
Fluazifop-P-butyl	NR	NR	NR	NR
MSMA	NR	NR	NR	NR
Terraclor	NR	NR	NR	NR
Curacon	NR	NR	NR	NR
Thidiazuron	NR	NR	NR	NR
Ethephon	NR	NR	NR	NR

August 11, 1997

	Conventionalt tillage	Conventional IPM, NM, CC	Conservation IPM, NM,	Conservation IPM, NM, CC TC
Trifluralin	no sample	NR	NR	NR
Pendimethalin		0.56 ppb	2.22 ppb	0.62 ppb
Fluometuron		ND	0.76 ppb	ND
Norflurazon		1.99 ppb	3.78 ppb	24.02 ppb
Aldicarb		0.02 ppb	0.13 ppb	1.7 ppb
Methyl Parathion		0.11 ppb	0.18 ppb	0.14 ppb
Malathion		NR	NR	NR
Chlorpyrifos		NR	NR	NR
Metolachlor		NR	NR	NR
Fluazifop-P-butyl		NR	NR	NR
MSMA		NR	NR	NR
Terraclor		NR	NR	NR
Curacon		NR	NR	NR
Thidiazuron		NR	NR	NR
Ethephon		NR	NR	NR
Karate		0.26 ppb	0.08 ppb	ND

10-27-97	Conventionalt tillage	Conventional IPM, NM, CC	Conservation IPM, NM,	Conservation IPM, NM, CC TC
Trifluralin	NR	NR	NR	NR
Pendimethalin	ND	ND	ND	ND
Fluometuron	ND	ND	ND	ND
Norflurazon	0.56 ppb	ND	ND	ND
Aldicarb	ND	ND	ND	ND
Methyl Parathion	ND	4.09 ppb	0.465 ppb	0.5 ppb
Malathion	NR	NR	NR	NR
Chlorpyrifos	NR	NR	NR	NR
Metolachlor	NR	NR	NR	NR
Fluazifop-P-butyl	NR	NR	NR	NR
MSMA	NR	NR	NR	NR
Terraclor	NR	NR	NR	NR
Curacon	NR	NR	NR	NR
Thidiazuron	NR	NR	NR	NR
Ethephon	NR	NR	NR	NR
Karate	ND	ND	ND	ND

WATER SAMPLES SUMMARY

12-01-97	Conventionalt tillage	Conventional IPM, NM, CC	Conservation IPM, NM,	Conservation IPM, NM, CC TC
Trifluralin	NR	NR	NO SAMPLE	NR
Pendimethalin	ND	ND		ND
Fluometuron	ND	ND		ND
Norflurazon	ND	ND		ND
Aldicarb	ND	ND		ND
Methyl Parathion	ND	ND		ND
Malathion	NR	NR		NR
Chlorpyrifos	NR	NR		NR
Metolachlor	NR	NR		NR
Fluazifop-P-butyl	NR	NR		NR
MSMA	NR	NR		NR
Terraclor	NR	NR		NR
Curacon	NR	NR		NR
Thidiazuron	NR	NR		NR
Ethephon	NR	NR		NR
Karate	ND	ND		ND

April 29, 1998	Conventional tillage 1,7,9	Conventional IPM, NM, CC 2,5,12	Conservation IPM, NM, 3,8,10	Conservation IPM, NM, CC TC 4, 6, 11
Trifluralin	ND	ND	ND	ND
Pendimethalin	24.4 ppb	17.5 ppb	10.8 ppb	6.06 ppb
Fluometuron	ND	ND	ND	ND
Norflurazon	ND	ND	ND	ND
Aldicarb	ND	ND	ND	ND
Methyl Parathion	ND	ND	ND	ND
Malathion	ND	ND	ND	ND
Chlorpyrifos	ND	ND	ND	ND
Metolachlor	ND	ND	ND	ND
Fluazifop-P-butyl	ND	ND	ND	ND
MSMA	ND	ND	ND	ND
Terraclor	ND	ND	ND	ND
Curacon	ND	ND	ND	ND
Thidiazuron	ND	ND	ND	ND
Ethephon	ND	ND	ND	ND

June 8, 1998	Conventional tillage 1,7,9	Conventional IPM, NM, CC 2,5,12	Conservation IPM, NM, 3,8,10	Conservation IPM, NM, CC TC 4, 6, 11
Trifluralin	No sample	NR	NR	NR
Pendimethalin		NR	NR	NR
Fluometuron		NR	NR	NR
Norflurazon		NR	NR	NR
Aldicarb		ND	ND	NR
Methyl Parathion		NR	NR	NR
Malathion		NR	NR	NR
Chlorpyrifos		NR	NR	NR
Metolachlor		NR	NR	NR
Fluazifop-P-butyl		NR	NR	NR
MSMA		NR	NR	NR
Terraclor		0.2 ppb	0.33 ppb	0.5 ppb
Curacon		NR	NR	NR
Thidiazuron		NR	NR	NR
Ethephon		NR	NR	NR
		plot 12 only	plots 3 & 8 only	plot 11 only

August 8, 1998	Conventional tillage 1, 7, 9	Conventional IPM, NM, CC 2, 5, 12	Conservation IPM, NM, 3, 8, 10	Conservation IPM, NM, CC TC 4, 6, 11
Trifluralin	NR	NR	NR	NR
Pendimethalin	NR	NR	NR	NR
Fluometuron	NR	NR	NR	NR
Norflurazon	NR	NR	NR	NR
Aldicarb	NR	NR	NR	NR
Methyl Parathion	1.63 ppb	2.16 ppb	0.45 ppb	2.76 ppb
Malathion	NR	NR	NR	NR
Chlorpyrifos	NR	NR	NR	NR
Metolachlor	NR	NR	NR	NR
Fluazifop-P-butyl	NR	NR	NR	NR
MSMA	NR	NR	NR	NR
Terraclor	NR	NR	NR	NR
Curacon	NR	NR	NR	NR
Thidiazuron	NR	NR	NR	NR
Ethephon	NR	NR	NR	NR
Karate	ND	ND	ND	ND

September 14, 1998	Conventional tillage 1, 7, 9	Conventional IPM, NM, CC 2, 5, 12	Conservation IPM, NM, 3, 8, 10	Conservation IPM, NM, CC TC 4, 6, 11
Trifluralin	NR	NR	NR	NR
Pendimethalin	NR	NR	NR	NR
Fluometuron	NR	NR	NR	NR
Norflurazon	NR	NR	NR	NR
Aldicarb	NR	NR	NR	NR
Methyl Parathion	0.93 ppb	0.72 ppb	1.2 ppb	0.67 ppb
Malathion	NR	NR	NR	NR
Chlorpyrifos	NR	NR	NR	NR
Metolachlor	NR	NR	NR	NR
Fluazifop-P-butyl	NR	NR	NR	NR
MSMA	NR	NR	NR	NR
Terraclor	NR	NR	NR	NR
Curacon	NR	NR	NR	NR
Thidiazuron	NR	NR	NR	NR
Ethephon	NR	NR	NR	NR
Karate	ND	ND	ND	ND

November 16, 1998	Conventional tillage 1, 7, 9	Conventional IPM, NM, CC 2, 5, 12	Conservation IPM, NM, 3, 8, 10	Conservation IPM, NM, CC TC 4, 6, 11
Trifluralin	NR	NR	NR	NR
Pendimethalin	NR	NR	NR	NR
Fluometuron	NR	NR	NR	NR
Norflurazon	NR	NR	NR	NR
Aldicarb	NR	NR	NR	NR
Methyl Parathion	ND	ND	ND	ND
Malathion	NR	NR	NR	NR
Chlorpyrifos	NR	NR	NR	NR
Metolachlor	NR	NR	NR	NR
Fluazifop-P-butyl	NR	NR	NR	NR
MSMA	NR	NR	NR	NR
Terraclor	NR	NR	NR	NR
Curacon	NR	NR	NR	NR
Thidiazuron	NR	NR	NR	NR
Ethephon	NR	NR	NR	NR
Karate	NR	NR	NR	NR

Appendix C: Economic Analysis of Best Management Practices & Production Data

ANALYSIS OF THE EFFECTS OF BEST MANAGEMENT PRACTICES IN COTTON PRODUCTION ON RUNOFF WATER QUALITY
(COSTS OF PRODUCTION)

Treatment 1 Conventional Tillage--Maximum Inputs
Date March 19, 1998

PLANTING AND GROWING COSTS (per acre)				
ITEM	UNIT	QUANTITY	$ PER UNIT	COST
Seed	lb.	12	0.82	9.84
HERBICIDES				
Prowl 3.3 EC	pt.	2.4	6.63	15.91
Zorial 80DF	lb.	1.9	13.60	25.84
Cotoran 4L	pt.	1	9.13	9.13
INSECTICIDES				
Temik 15G	lb.	5.00	2.90	14.50
Orthene 75S	lb.	0.25	9.50	2.38
Vydate CLV	gal.	0.125	61.00	7.63
Curacron 8E	pt.	5.0	12.55	62.75
Methyl parathion 4E	pt.	4.5	3.16	14.22
Karate 1E	pt.	1.0	25.63	25.63
FUNGICIDE				
TSX	lb.	8.0	1.95	15.60
FERTILIZERS				
Nitrogen	lb.	90	0.26	23.40
Potash	lb.	150	0.12	18.00
FUEL and LABOR				
Tractor Fuel	gal.	22	0.85	18.70
Scouting	acre	1	7.50	7.50
EQUIPMENT COST (Variable and Fixed)				
Airplane	acre	9	2.15	19.35
Repair and Maint	acre	1	46.11	46.11
Fixed Costs	acre	1	70.48	70.48
HARVESTING COST				
Defoliants (Finish)	gal.	0.5	54.00	27.00
Mod. Hauling	bale	2.12	5.00	10.60
Ginning	lb.	1,019	0.08	81.52
OTHER EXPENSES				
Interest	acre	1	13.94	13.94
Labor	hr.	3.4	7.50	25.50
Overhead	acre	1	64.48	64.48
Oppor. Cost	acre	1	90.00	90.00
			TOTAL COST	720.01

INCOME				
Cotton Lint	lb.	1,019	0.65	662.35
Cotton Seed	lb.	1,388	0.05	69.40
Cotton Checkoff	bale	2.12	2.56	-5.43
			TOTAL INCOME	726.32

RESIDUAL RETURNS	
Total Income per acre	726.32
Total Costs per acre	720.01
Residual Returns per acre	6.31

ANALYSIS OF THE EFFECTS OF BEST MANAGEMENT PRACTICES IN COTTON PRODUCTION ON RUNOFF WATER QUALITY
(COSTS OF PRODUCTION)

Treatment 2 Conventional Tillage---Standard Inputs--IPM, NM, CC
Date March 19, 1998

PLANTING AND GROWING COSTS (per acre)				
ITEM	UNIT	QUANTITY	$ PER UNIT	COST
Seed	lb.	12	0.82	9.84
HERBICIDES				
Prowl 3.3 EC	pt.	2.4	6.63	15.91
Zorial 80DF	lb.	1.9	13.60	25.84
Cotoran 4L	pt.	1	9.13	9.13
INSECTICIDES				
Temik 15G	lb.	5.00	2.90	14.50
Orthene 75S	lb.	0.25	9.50	2.38
Vydate CLV	gal.	0.125	61.00	7.63
Curacron 8E	pt.	5.0	12.55	62.75
Methyl parathion 4E	pt.	4.0	3.16	12.64
Karate 1E	pt.	1.0	25.63	25.63
FUNGICIDE				
TSX	lb.	8.0	1.95	15.60
FERTILIZERS				
Nitrogen	lb.	90	0.26	23.40
Potash	lb.	150	0.12	18.00
FUEL and LABOR				
Tractor Fuel	gal.	23	0.85	19.55
Scouting	acre	1	7.50	7.50
EQUIPMENT COST (Variable and Fixed)				
Airplane	acre	8	2.15	17.20
Repair and Maint	acre	1	47.54	47.54
Fixed Costs	acre	1	71.70	71.70
HARVESTING COST				
Defoliants (Finish)	gal.	0.5	54.00	27.00
Mod. Hauling	bale	2.82	5.00	14.10
Ginning	lb.	1,351.87	0.08	108.15
OTHER EXPENSES				
Interest	acre	1	13.94	13.94
Labor	hr.	3.48	7.50	26.10
Overhead	acre	1	64.48	64.48
Oppor. Cost	acre	1	90.00	90.00
			TOTAL COST	750.51

INCOME				
Cotton Lint	lb.	1,351.87	0.65	878.72
Cotton Seed	lb.	1,849.57	0.05	92.48
Cotton Checkoff	bale	2.82	2.56	-7.22
			TOTAL INCOME	963.98

RESIDUAL RETURNS	
Total Income per acre	963.98
Total Costs per acre	750.51
Residual Returns per acre	213.47

ANALYSIS OF THE EFFECTS OF BEST MANAGEMENT PRACTICES IN COTTON PRODUCTION ON RUNOFF WATER QUALITY
(COSTS OF PRODUCTION)

Treatment 3 Conservation Tillage---IPM, NM
Date March 19, 1998

PLANTING AND GROWING COSTS (per acre)				
ITEM	UNIT	QUANTITY	$ PER UNIT	COST
Seed	lb.	12	0.82	9.84
HERBICIDES				
Prowl 3.3 EC	pt.	2.4	6.63	15.91
Zorial 80DF	lb.	1.9	13.60	25.84
Cotoran 4L	pt.	1	9.13	9.13
INSECTICIDES				
Temik 15G	lb.	5.00	2.90	14.50
Orthene 75S	lb.	0.25	9.50	2.38
Vydate CLV	gal.	0.125	61.00	7.63
Curacron 8E	pt.	5.0	12.55	62.75
Methyl parathion 4E	pt.	4.0	3.16	12.64
Karate 1E	pt.	1.0	25.63	25.63
FUNGICIDE				
TSX	lb.	8.0	1.95	15.60
FERTILIZERS				
Nitrogen	lb.	90	0.26	23.40
Potash	lb.	150	0.12	18.00
FUEL and LABOR				
Tractor Fuel	gal.	22	0.85	18.70
Scouting	acre	1	7.50	7.50
EQUIPMENT COST (Variable and Fixed)				
Airplane	acre	9	2.15	19.35
Repair and Maint	acre	1	46.11	46.11
Fixed Costs	acre	1	70.48	70.48
HARVESTING COST				
Defoliants (Finish)	gal.	0.5	54.00	27.00
Mod. Hauling	bale	2.16	5.00	10.80
Ginning	lb.	1,036	0.08	82.88
OTHER EXPENSES				
Interest	acre	1	13.94	13.94
Labor	hr.	3.4	7.50	25.50
Overhead	acre	1	64.48	64.48
Oppor. Cost	acre	1	90.00	90.00
			TOTAL COST	719.99

INCOME				
Cotton Lint	lb.	1,036	0.65	673.40
Cotton Seed	lb.	1,417	0.05	70.85
Cotton Checkoff	bale	2.16	2.56	-5.53
			TOTAL INCOME	738.72

RESIDUAL RETURNS	
Total Income per acre	738.72
Total Costs per acre	719.99
Residual Returns per acre	18.73

ANALYSIS OF THE EFFECTS OF BEST MANAGEMENT PRACTICES IN COTTON PRODUCTION ON RUNOFF WATER QUALITY (COSTS OF PRODUCTION)

Treatment 4 Conservation Tillage--IPM, NM, CC, Transgenic
Date March 19, 1998

PLANTING AND GROWING COSTS (per acre)				
ITEM	UNIT	QUANTITY	$ PER UNIT	COST
Seed	lb.	12	1.05	12.60
Bt Cotton Fee	acre	1	32.00	32.00
HERBICIDES				
Prowl 3.3 EC	pt.	2.4	6.63	15.91
Zorial 80DF	lb.	1.9	13.60	25.84
Cotoran 4L	pt.	1	9.13	9.13
INSECTICIDES				
Temik 15G	lb.	5.00	2.90	14.50
Orthene 75S	lb.	0.25	9.50	2.38
Vydate CLV	gal.	0.125	61.00	7.63
Methyl parathion 4E	pt.	4.0	3.16	12.64
FUNGICIDE				
TSX	lb.	8.0	1.95	15.60
FERTILIZERS				
Nitrogen	lb.	90	0.26	23.40
Potash	lb.	150	0.12	18.00
FUEL and LABOR				
Tractor Fuel	gal.	23	0.85	19.55
Scouting	acre	1	7.50	7.50
EQUIPMENT COST (Variable and Fixed)				
Airplane	acre	8	2.15	17.20
Repair and Maint	acre	1	47.54	47.54
Fixed Costs	acre	1	71.70	71.70
HARVESTING COST				
Defoliants (Finish)	gal.	0.5	54.00	27.00
Mod. Hauling	bale	3.08	5.00	15.40
Ginning	lb.	1,477	0.08	118.16
OTHER EXPENSES				
Interest	acre	1	13.94	13.94
Labor	hr.	3.48	7.50	26.10
Overhead	acre	1	64.48	64.48
Oppor. Cost	acre	1	90.00	90.00
			TOTAL COST	708.20

INCOME				
Cotton Lint	lb.	1,477	0.65	960.05
Cotton Seed	lb.	2,131	0.05	106.55
Cotton Checkoff	bale	3.08	2.56	-7.88
			TOTAL INCOME	1,058.72

RESIDUAL RETURNS	
Total Income per acre	1,058.72
Total Costs per acre	708.20
Residual Returns per acre	350.52

ANALYSIS OF THE EFFECTS OF BEST MANAGEMENT PRACTICES IN COTTON PRODUCTION ON RUNOFF WATER QUALITY
(COSTS OF PRODUCTION, INCOME, RESIDUAL RETURNS)

Treatment 1 Conventional Tillage---Maximum Inputs
Date Jan. 19, 1999

PLANTING AND GROWING COSTS (per acre)				
ITEM	UNIT	QUANTITY	$ PER UNIT	COST
Seed	lb.	12	0.82	9.84
HERBICIDES				
Prowl 3.3 EC	pt.	2.4	6.63	15.91
Fusilade	lb.	1	14.54	14.54
Staple	oz.	1.2	20.00	24.00
INSECTICIDES				
Temik 15G	lb.	5.00	2.90	14.50
Orthene 75S	lb.	0.25	9.50	2.38
Vydate CLV	gal.	0.125	61.00	7.63
Curacron 8E	pt.	1.5	12.55	18.83
Methyl parathion 4E	pt.	9.00	3.16	28.44
Karate 1E	pt.	1.0	25.63	25.63
Provado	oz.	3.75	3.28	12.30
Larvin	pt.	4.5	6.37	28.67
FUNGICIDE				
TSX	lb.	8.0	1.95	15.60
FERTILIZERS				
Nitrogen	lb.	90	0.26	23.40
Potash	lb.	150	0.12	18.00
FUEL and LABOR				
Tractor Fuel	gal.	22	0.85	18.70
Scouting	acre	1	7.50	7.50
EQUIPMENT COST (Variable and Fixed)				
Airplane	acre	9	2.15	19.35
Repair and Maint	acre	1	46.11	46.11
Fixed Costs	acre	1	70.48	70.48
HARVESTING COST				
Defoliants (Finish)	gal.	0.5	54.00	27.00
Mod. Hauling	bale	1.56	5.00	7.80
Ginning	lb.	751	0.08	60.08

OTHER EXPENSES				
Interest	acre	1	13.94	13.94
Labor	hr.	3.4	7.50	25.50
Overhead	acre	1	64.48	64.48
Oppor. Cost	acre	1	90.00	90.00
			TOTAL COST	710.61

INCOME				
Cotton Lint	lb.	751	0.65	488.15
Cotton Seed	lb.	1127	0.05	56.35
Cotton Checkoff	bale	1.56	2.56	3.99
			TOTAL INCOME	540.51

RESIDUAL RETURNS	
Total Income per acre	540.51
Total Costs per acre	710.61
Residual Returns per acre	-170.10

ANALYSIS OF THE EFFECTS OF BEST MANAGEMENT PRACTICES IN COTTON PRODUCTION ON RUNOFF WATER QUALITY
(COSTS OF PRODUCTION, INCOME, RESIDUAL RETURNS)

Treatment 2 Conventional Tillage---Standard Inputs--IPM, NM, CC
Date Jan. 19, 1999

PLANTING AND GROWING COSTS (per acre)				
ITEM	UNIT	QUANTITY	$ PER UNIT	COST
Seed	lb.	12	0.82	9.84
HERBICIDES				
Prowl 3.3 EC	pt.	2.4	6.63	15.91
Fusilade	lb.	1	14.54	14.54
Staple	oz.	1.2	20.00	24.00
INSECTICIDES				
Temik 15G	lb.	5.00	2.90	14.50
Orthene 75S	lb.	0.25	9.50	2.38
Vydate CLV	gal.	0.125	61.00	7.63
Curacron 8E	pt.	1.5	12.55	18.83
Methyl parathion 4E	pt.	5.625	3.16	17.78
Karate 1E	pt.	0.6	25.63	15.38
Provado	oz.	3.75	3.28	12.30
Larvin	pt.	3.0	6.37	19.11
FUNGICIDE				
TSX	lb.	8.0	1.95	15.60
FERTILIZERS				
Nitrogen	lb.	90	0.26	23.40
Potash	lb.	150	0.12	18.00
FUEL and LABOR				
Tractor Fuel	gal.	21	0.85	17.85
Scouting	acre	1	7.50	7.50
EQUIPMENT COST (Variable and Fixed)				
Airplane	acre	8	2.15	17.20
Repair and Maint	acre	1	47.54	47.54
Fixed Costs	acre	1	71.70	71.70
HARVESTING COST				
Defoliants (Finish)	gal.	0.5	54.00	27.00
Mod. Hauling	bale	1.57	5.00	7.85
Ginning	lb.	753	0.08	60.24

OTHER EXPENSES				
Interest	acre	1	13.94	13.94
Labor	hr.	3.2	7.50	24.00
Overhead	acre	1	64.48	64.48
Oppor. Cost	acre	1	90.00	90.00
			TOTAL COST	678.50

INCOME				
Cotton Lint	lb.	753	0.65	489.45
Cotton Seed	lb.	1,130	0.05	56.50
Cotton Checkoff	bale	1.57	2.56	-4.02
			TOTAL INCOME	541.93

RESIDUAL RETURNS	
Total Income per acre	541.93
Total Costs per acre	678.50
Residual Returns per acre	-136.67

ANALYSIS OF THE EFFECTS OF BEST MANAGEMENT PRACTICES IN COTTON PRODUCTION ON RUNOFF WATER QUALITY
(COSTS OF PRODUCTION, INCOME, RESIDUAL RETURNS)

Treatment 3 Conservation Tillage---IPM, NM
Date Jan. 19, 1999

PLANTING AND GROWING COSTS (per acre)				
ITEM	UNIT	QUANTITY	$ PER UNIT	COST
Seed	lb.	12	0.82	9.84
HERBICIDES				
Prowl 3.3 EC	pt.	2.4	6.63	15.91
Fusilade	lb.	1	14.54	14.54
Staple	oz.	1.2	20.00	24.00
Roundup	pt.	1	6.10	6.10
INSECTICIDES				
Temik 15G	lb.	5.00	2.90	14.50
Orthene 75S	lb.	0.25	9.50	2.38
Vydate CLV	gal.	0.125	61.00	7.63
Curacron 8E	pt.	1.5	12.55	18.83
Methyl parathion 4E	pt.	5.625	3.16	17.78
Karate 1E	pt.	0.6	25.63	15.38
Provado	oz.	3.75	3.28	12.30
Larvin	pt.	3.0	6.37	19.11
FUNGICIDE				
TSX	lb.	8.0	1.95	15.60
FERTILIZERS				
Nitrogen	lb.	90	0.26	23.40
Potash	lb.	150	0.12	18.00
FUEL and LABOR				
Tractor Fuel	gal.	21	0.85	17.85
Scouting	acre	1	7.50	7.50
EQUIPMENT COST (Variable and Fixed)				
Airplane	acre	9	2.15	19.35
Repair and Maint	acre	1	46.11	46.11
Fixed Costs	acre	1	70.48	70.48
HARVESTING COST				
Defoliants (Finish)	gal.	0.5	54.00	27.00
Mod. Hauling	bale	1.79	5.00	8.95
Ginning	lb.	861	0.08	68.88

OTHER EXPENSES				
Interest	acre	1	13.94	13.94
Labor	hr.	3.2	7.50	24.00
Overhead	acre	1	64.48	64.48
Oppor. Cost	acre	1	90.00	90.00
			TOTAL COST	693.84

736.50

INCOME				
Cotton Lint	lb.	861	0.65	559.65
Cotton Seed	lb.	1,292	0.05	64.60
Cotton Checkoff	bale	1.79	2.56	-4.58
			TOTAL INCOME	619.57

RESIDUAL RETURNS	
Total Income per acre	619.57
Total Costs per acre	693.84
Residual Returns per acre	-74.27

ANALYSIS OF THE EFFECTS OF BEST MANAGEMENT PRACTICES IN COTTON PRODUCTION ON RUNOFF WATER QUALITY
(COSTS OF PRODUCTION, INCOME, RESIDUAL RETURNS)

Treatment 4 Conservation Tillage---IPM, NM, CC, Transgenic
Date Jan. 19, 1999

PLANTING AND GROWING COSTS (per acre)				
ITEM	UNIT	QUANTITY	$ PER UNIT	COST
Seed	lb.	12	1.05	12.60
Bt Cotton Fee	acre	1	32.00	32.00
HERBICIDES				
Prowl 3.3 EC	pt.	2.4	6.63	15.91
Fusilade	lb.	1	14.54	14.54
Staple	oz.	1.2	20.00	24.00
Roundup	pt.	1	6.10	6.10
INSECTICIDES				
Temik 15G	lb.	5.00	2.90	14.50
Orthene 75S	lb.	0.25	9.50	2.38
Vydate CLV	gal.	0.125	61.00	7.63
Methyl parathion 4E	pt.	5.625	3.16	17.78
Provado	oz.	0.0	3.28	0.0
Larvin	pt.	1.5	6.37	9.56
FUNGICIDE				
TSX	lb.	8.0	1.95	15.60
FERTILIZERS				
Nitrogen	lb.	90	0.26	23.40
Potash	lb.	150	0.12	18.00
FUEL and LABOR				
Tractor Fuel	gal.	19	0.85	16.15
Scouting	acre	1	7.50	7.50
EQUIPMENT COST (Variable and Fixed)				
Airplane	acre	8	2.15	17.20
Repair and Maint	acre	1	47.54	47.54
Fixed Costs	acre	1	71.70	71.70
HARVESTING COST				
Defoliants (Finish)	gal.	0.5	54.00	27.00
Mod. Hauling	bale	1.70	5.00	8.50
Ginning	lb.	817	0.08	65.36

OTHER EXPENSES				
Interest	acre	1	13.94	13.94
Labor	hr.	3.0	7.50	22.50
Overhead	acre	1	64.48	64.48
Oppor. Cost	acre	1	90.00	90.00
			TOTAL COST	665.87

INCOME				
Cotton Lint	lb.	817	0.65	531.05
Cotton Seed	lb.	1226	0.05	61.30
Cotton Checkoff	bale	1.70	2.56	-4.35
			TOTAL INCOME	588.00

RESIDUAL RETURNS	
Total Income per acre	588.00
Total Costs per acre	665.87
Residual Returns per acre	-77.87

Appendix D: Soil Tests & Organic Matter

Mississippi Cooperative Extension Service
Mississippi State University and U.S. Dept. of Agriculture Cooperating

Plant and Soil Sciences-----Soil Testing Lab   0000
Box 9610
Mississippi State, MS 39762

April 2, 1998

K S Mclean
Northeast Louisiana Univ.
Monroe, LA 71209

Agent: AAA-000897

Uncl County

Lab# : 4038-4049

eld ID	Extractable Nutrient Levels(lbs/acre) PH	P	K	CA	MG	S	ZN	NA	CEC	%OM	Recommended Lime (Tons/Acre)	Needed Plant Nutrients Pounds Per Acre YR	N	P205	K20	Example of Fertilizer Mixture to Supply Recommended Plant Nutrients Example 1	Example 2
	6.4	132 H	226 H	1404	189 H+	93 L	1.0 M	71	6.3	.65	0.0	1	0		40	See N comment 67# 0-0-60	
												2	0			See N comment	
												3	0			See N comment	
op : Cotton																	
Bottom of Report, See Comment Nos. 20, 9020, 9180																	
	6.4	124 H	200 M	1206	156 H+	60 VL	0.5 L	76	5.8	.42	0.0	1	0		60	See N comment 100# 0-0-60	
												2	0		40	See N comment	
												3	0		40	See N comment	
op : Cotton																	
: Bottom of Report, See Comment Nos. 20, 9020, 9180																	
	6.3	108 H	138 L	1246	138 H+	74 L	0.7 L	64	5.7	.52	0.0	1	0		90	See N comment 150# 0-0-60	
												2	0		80	See N comment 133# 0-0-60	
												3	0		80	See N comment 133# 0-0-60	
rop : Cotton																	
t Bottom of Report, See Comment Nos. 20, 9020, 9180																	
	6.4	128 H	141 L	1417	136 H+	87 L	0.7 L	75	6.3	.61	0.0	1	0		90	See N comment 150# 0-0-60	
												2	0		80	See N comment 133# 0-0-60	
												3	0		80	See N comment 133# 0-0-60	
rop : Cotton																	
t Bottom of Report, See Comment Nos. 20, 9020, 9180																	

AA-000897 Soil Test Results Page : 2

d	Extractable Nutrient Levels(lbs/acre)										Recommended Lime	Needed Plant Nutrients Pounds Per Acre				Example of Fertilizer Mixture to Supply Recommended Plant Nutrients	
	PH	P	K	CA	MG	S	ZN	NA	CEC	%OM	(Tons/Acre)	YR	N	P2O5	K2O	Example 1	Example 2
	6.6	105 H	185 M	1187	138 H+	87 L	0.6 L	73	5.7	.61	0.0	1	0		60	See N comment 100# 0-0-60	
												2	0		40	See N comment	
												3	0		40	See N comment	

i : Cotton

lottom of Report, See Comment Nos. 20, 9020, 9180

	6.8	89 H	121 L	1255	132 H+	79 L	0.9 M	71	5.5	.55	0.0	1	0		90	See N comment 150# 0-0-60	
												2	0		80	See N comment 133# 0-0-60	
												3	0		80	See N comment 133# 0-0-60	

p : Cotton

Bottom of Report, See Comment Nos. 20, 9020, 9180

	6.7	105 H	191 M	1207	158 H+	95 L	0.7 L	70	5.7	.66	0.0	1	0		60	See N comment 100# 0-0-60	
												2	0		40	See N comment	
												3	0		40	See N comment	

ip : Cotton

Bottom of Report, See Comment Nos. 20, 9020, 9180

	6.6	98 H	147 L	1387	141 H+	89 L	0.4 VL	71	5.6	.62	0.0	1	0		90	See N comment 150# 0-0-60	
												2	0		80	See N comment 133# 0-0-60	
												3	0		80	See N comment 133# 0-0-60	

op : Cotton

Bottom of Report, See Comment Nos. 20, 9020, 9180

	6.9	101 H	213 H	1180	160 H+	99 L	0.5 VL	70	5.4	.69	0.0	1	0		40	See N comment 67# 0-0-60	
												2	0			See N comment	
												3	0			See N comment	

op : Cotton

: Bottom of Report, See Comment Nos. 20, 9020, 9180

	...able Nutrient Levels(lbs/acre) P	K	CA	MG	S	ZN	NA	CEC	%OM	Recommended Lime (Tons/Acre)	Needed Plant Nutrients Pounds Per Acre YR	N	P2O5	K2O	Example of Fertilizer Mixture to Supply Recommended Plant Nutrients Example 1	Example 2
6.1	111 M	120 L	1405	160 H+	79 L	0.9 M	111	5.7	.55	0.0	1	0		90	See N comment 150# 0-0-60	
											2	0		80	See N comment 133# 0-0-60	
											3	0		80	See N comment 133# 0-0-60	

op : Cotton

Bottom of Report, See Comment Nos. 20, 9020, 9180

	P	K	CA	MG	S	ZN	NA	CEC	%OM	Lime	YR	N	P2O5	K2O	Example 1	Example 2
7.3	72 M	135 L	1193	213 H+	72 L	0.7 L	260	4.0	.50	0.0	1	@@@	40	90	See N comment 267# 0-15-30 17# 0-0-60	
											2	@@@	40	80	See N comment 267# 0-15-30	
											3	@@@	40	80	See N comment 267# 0-15-30	

op : Cotton

: Bottom of Report, See Comment Nos. 20, 9020, 9180

	P	K	CA	MG	S	ZN	NA	CEC	%OM	Lime	YR	N	P2O5	K2O	Example 1	Example 2
7.0	66 M	178 M	1207	252 H+	132 L	1.0 L	122	4.3	.92	0.0	1	@@@	40	60	See N comment 167# 0-24-24 33# 0-0-60	See N comment 200# 0-20-20
											2	@@@	40	40	See N comment 167# 0-24-24	See N comment 200# 0-20-20
											3	@@@	40	40	See N comment 167# 0-24-24	See N comment 200# 0-20-20

rop : Cotton

t Bottom of Report, See Comment Nos. 20, 9020, 9180

eys: *PH = Soil Acidity
*P = Phosphorus
*CA = Calcium
*MG = Magnesium
*S = Sulfur
*ZN = Zinc
*NA = Sodium

*K = Potassium
*N = Nitrogen
*OM = Organic Matter
*P205 = *Phosphate*
*K20 = Potash
*CEC = Cation Exchange Capacity

*VL = Very Low
*L = Low
*M = Medium
*H+ = Very
*EX = Excessive
*TX = Toxic

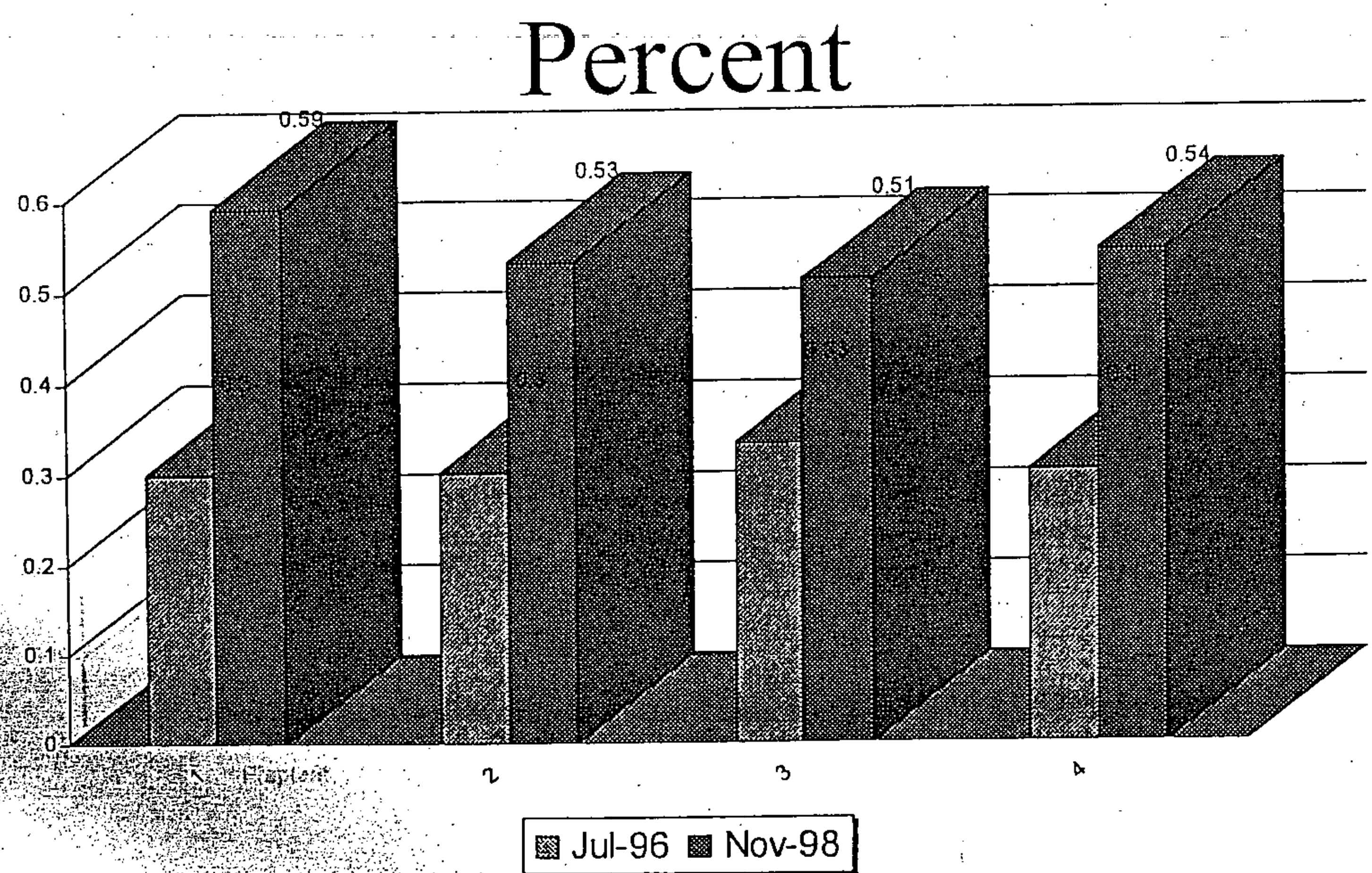
These are only examples for each mixture; other fertilizer mixtures can be used. Call your county agent if you need assistance determining the amount of other mixtures to be applied.

Comment: 20 Nitrogen (Cotton) Comment. Use 50 - 60 lbs of N per bale on light-textured soils; use 60 - 70 lbs of N per bale on medium-textured soils; and use 70 - 80 lbs of N per bale on clays. Remember, the yield goal selected must be realistic. Additional N will not increase yields unless nitrogen deficiency is the yield limiting *factor. Increase* the potash rate by 50% if there is a realistic probability of producing 2 or more bales an acre. The 40 lbs of K recommended for cotton with H levels of K is suggested in order to help maintain the existing high soil testing levels.

Comment: 9020 The sulfur level reported is a calculation based on the organic matter level and is an indication of the potential reserve sulfur *from* this source. *For this reason, fertilizer sulfur* is *not* indicated by this test and a field that is low in organic matter will show a low sulfur level, even if sulfur fertilizer has been applied. Use the sulfur level as a guide for the need of applications of sulfur fertilizer, particularly on cotton, corn, sorghum, commercial horticulture crops, and hay crops.

Comment: 9180 Boron comment:For all non-delta areas, use 1/3 to 1/2 lb boron annually. For delta areas, boron may boost yields on non-irrigated soils in dry weather, particularly if the field has been recently limed.

Soil Organic Matter



Appendix E: Floristic Survey of Bennett Bayou

On November 4,1998, the four locations were resampled along Bennett Bayou. Microscope slides were recovered from all but location 2. Only one slide was recovered from locations 1 and 4 and all four slides were recovered from 3. New slides were placed in the water for sampling in the spring of next year. Slide recovery may have been poor due to recent water level fluctuation.

Only one slide was recovered from location 1. There were few organisms noticed. Diatoms were present at a density of about one individual per field of view and the alga *Ulothrix* was present at less than one individual per field. There was some *Nitella* floating in the water.

No slides were recovered from location 2.

In contrast to the August sampling, all four slides at location 3 were recovered. *Volvox* was present at about 1 individual per field. Diatoms were occasional and a Desmid, probably *Closterium*, was present at 1 per field. There was no *Nitella* observed as there was in August. The floating aquatic plant *Pistea stratiotes* (water lettuce) was found at location 3. This is the first time it has been collected in Ouachita Parish since 1975, according to holdings in the NLU herbarium.

Only one slide was recovered from location 4. It yielded occasional filamentous algae and individuals of *Volvox*. Diatoms were present at 3 individuals per field and a Desmid was present at a rate of one individual per field.

The plant species along the adjacent banks were identified at each of the four locations. *Pistea stratiotes* was the only additional species found. A complete cumulative (1997 and 1998) listing of all 93 species (72 herbaceous and 22 woody) observed is in Table 1. Location 3 had the most total species with 46, followed by Location 1 with 43, and both Locations 2 and 4 with 38 each. For herbaceous species, Location 3 had 39 followed by Locations 1 and 4 with 31. Location 2 had the least diverse assemblage of herbaceous plants with 29. For woody species, Location 1 had 12, location 2 had nine, and both Location 3 and 4 had seven species. Nine species are now recorded from all four Locations, ten from three Locations, 23 from two Locations, and 52 from one location only.

CONCLUSIONS

As has been the case over the past two years (1996 and 1997), the diversity and numbers of algae are higher in May and August than in October of 1998. Locations 2 and 3 are still the most diverse for algae and have been since the beginning of the sampling. It seems that runoff from the Best Management Practices is not affecting the algal populations; the algal populations have not changed much from the beginning. The vascular plants along the banks have also not been affected. The Locations still have the same relative numbers of species present.

Table 1. List of Plant Species from four sampling Locations in Bennett's Bayou during the 1996-1998 sampling periods.

species	Location Number 1	2	3	4	total
		Herbaceous			
Alternanthera philoxeroides	+	+	+	+	4
Amaranthus hybridus	-	-	+	+	2
Ambrosia artemisifolia	-	+	+	-	2
Ambrosia trifida	+	+	+	+	4
Ammannia	-	-	+	-	1
Andropogon virginicus	-	-	-	+	1
Apios americana	-	+	+	+	3
Aster	+	+	-	-	2
Axonopus affinis	+	-	-	-	1
Boehmeria cylindrica	+	+	+	+	4
Carex caroliniana	+	-	-	-	1
Carex frankii	-	-	+	-	1
Cassia fasciculata	+	-	+	-	2
Cerataphylum demersum	-	+	-	-	1
Commelina virginica	+	+	+	-	3
Cyperus retrorsus	-	+	-	-	1
Cyperus virens	-	-	-	+	1
Desmanthus illionensis	-	-	-	+	1
Desmodium	+	-	+	+	3
Digitaria ciliaris	-	-	-	+	1
Diodia virginiana	-	+	+	-	2
Echinochloa colona	-	-	+	-	1
Eclipta alba	-	+	+	-	2
Elymus virginicus	+	+	+	+	4
Eupatorium coelestinum	-	-	+	-	1
Eupatorium serotinum	+	+	-	-	2
Fimbristylis autumnalis	+	-	-	-	1
Galium tinctorium	+	-	+	-	2
Heliotropium indicum	-	-	-	+	1
Heteranthera reniformis	+	+	+	-	3
Heteranthera limosa	+	-	-	-	1
Hypericum mutilum	+	-	-	-	1
Ipomea	+	+	-	-	2
Iva annua	+	+	+	+	4
Juncus diffussisimus	+	+	-	-	2
Juncus effusus	-	-	-	+	1
Juncus tenuis	-	-	-	+	1
Leersia oryzoides	-	-	+	+	2
Leersia virginica	+	+	+	+	2
Lemna	-	+	-	-	1
Lepidium virginicum	-	-	+	-	1
Leptochloa panicoides	-	-	-	+	1
Lindernia dubia	-	-	+	+	2
Lolium perenne	+	-	-	-	1
Ludwigia decurrens	-	+	-	-	1
Ludwigia palustris	+	-	+	-	2
Ludwigia peploides	-	-	+	-	1
Lycopus	-	-	+	-	1
Lythrum alatum	+	+	+	-	3
Mikania scandens	+	+	+	-	3
Phyla lanceolata	-	-	-	+	1
Phytolacca americana	-	-	+	-	1
Pistea stratiotes	-	-	+	-	1
Pluchea camphorata	+	+	-	+	3
Polygonum spp.	+	+	+	+	4
Ptilimnium capillaceum	+	+	+	-	3
Ranunculus sardouus	+	-	-	-	1
Rotala ramosior	-	-	-	+	1
Rumex verticillatus	-	-	+	+	2
Sagittaria montevidensis	-	+	+	-	2

Table 1 (Cont.). List of Plant Species from four sampling Locations in Bennett's Bayou during the 1996-1998 sampling periods.

species	Location Number 1	2	3	4	total
		Herbaceous			
Sagittaria platyphylla	-	-	+	-	1
Saururus cernuus	-	-	-	+	1
Scirpus tabaermontana	-	+	+	-	2
Sesbania vesicaria	+	+	+	+	4
Solanum carolinense	-	-	-	+	1
Sonchus spp.	+	-	-	+	2
Sorghum halepense	-	-	-	+	1
Spilanthes americana	-	-	+	-	1
Spirodela	-	+	+	-	2
Trifolium repens	+	-	-	-	1
Tripsacum dactyloides	-	-	-	+	1
Xanthium strumarium	-	-	-	+	1
		Woody			
Acer negundo	+	-	-	+	2
Ampelopsis arborea	+	-	+	+	3
Ampelopsis cordata	+	-	+	-	2
Baccharis halimifolia	+	+	+	+	4
Brunnichia ovata	-	+	-	+	2
Campsis readicans	-	-	+	+	2
Carya spp.	-	+	-	-	1
Diospyros virginiana	-	+	-	-	1
Lonicera japonica	+	+	-	-	2
Platanus occidentalis	-	-	-	+	1
Prunus serotina	-	+	-	-	1
Quercus nigra	+	-	+	+	3
Quercus pagoda	+	-	-	-	1
Rhus radicans	-	+	-	-	1
Rubus trivialis	+	-	-	-	1
Salix nigra	+	-	-	-	1
Sapium sebiferum	+	-	-	-	1
Sassafras albidum	-	+	-	-	1
Taxodium distichum	-	-	+	-	1
Trachelopsermum difforme	+	-	-	-	1
Ulmus alata	-	+	-	-	1
Ulmus americana	+	-	+	-	2
total	43	38	45	38	
woody	12	9	7	7	
herbaceous	31	29	38	31	

Appendix F: Education – Field Days & Technical Reports

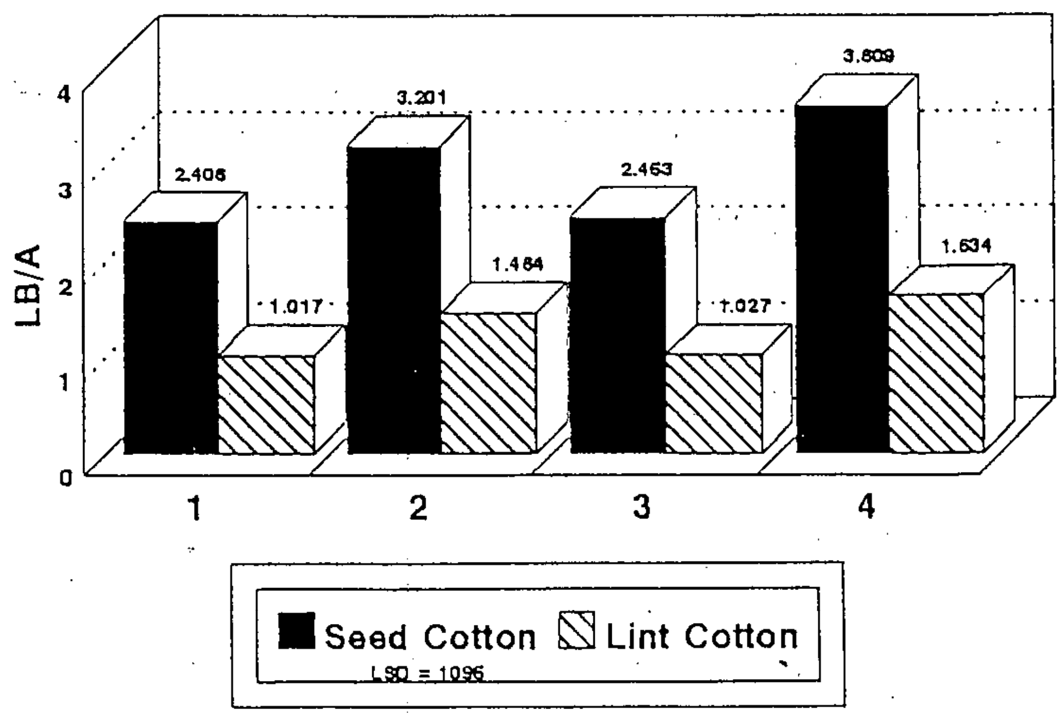
Analysis of the Effects of Best Management Practices on Runoff Water Quality in Cotton Production.

Kathy S. McLean, Ph.D. Associate Professor, Northeast Louisiana University
G. W. Lawrence, Ph.D Associate Professor, Mississippi State University
John Barnett, Ph.D. Quachita Parish County Agent, Louisiana State University Agricultural Center
Steve Nipper, Natural Resource Conservation Service
Robert Neal, Ph. D., Assistant Professor, Northeast Louisiana Univeristy
Buck Bounds, Ph.D. Professor, Northeast Louisiana University
Debbie Brotherton, Director, Plant and Soil Analysis Lab, Northeast Louisiana University
Shane Bray, Nick Greer, Cody Marsh, Mark Marionneaux and Delaine Young
Agribusiness students, Northeast Louisiana University

1 rep 1	2 rep 1	3 rep 1	4 rep 1	2 rep 2	4 rep 2	1 rep 2	3 rep 2	1 rep 3	3 rep 3	4 rep 3	2 rep 3

Treatments:
1 : Conventional Tillage, maximun imputs
2 : Conventional tillage, IPM, cover crop
3 : Conservation tillage, IPM
4 : Conservation tillage, IPM, Transgenic cotton, cover crop

Seed and Lint Cotton Yield 1997



The Analysis of the Effects of Best Management Practices in Cotton Production on Runoff Water Quality:
Summary of the Costs of Production, Income, and Residual Returns for 1997

For the production year 1997, all four treatments generated positive net returns. However, net or residual returns for treatments 1 and 3 were lower than would be necessary to generate an adequate return to operator's labor and management or operator's capital investment.

Treatment 4, Conservation Tilllage-Transgenic, produced the most cotton lint per acre (1,477 lbs.) at the lowest cost of the four treatments ($708.20) resulting in the greatest income per acre ($1,058.72) and the highest residual returns per acre ($350.52).

Treatment 1, Conventional Tillage-Maximum Inputs, produced the fewest pounds of cotton lint per acre (1,019 lbs.) and the lowest income per acre ($726.32), while Treatment 2, Conventional Tillage Standard Inputs, generated the highest per acre costs of production ($750.51).

A complete summary of yields, costs of production, income, and residual returns per acre are shown in the following tables.

Total Costs of Production, 1997

Treatment	Total Cost per Acre
1--Conventional Tillage-Maximum Inputs	$720.01
2--Conventional Tillage-Standard Inputs	$750.51
3--Conservation Tillage-IPM, NM	$719.99
4--Conservation Tillage-Transgenic	$708.20

Cotton Lint Production, 1997

Treatment	Cotton Lint (lbs. per acre)
1--Conventional Tillage-Maximum Inputs	1,019
2--Conventional Tillage-Standard Inputs	1,352
3--Conservation Tillage-IPM, NM	1,036
4--Conservation Tillage-Transgenic	1,477

Total Income, 1997

Treatment	Total Income per Acre
1--Conventional Tillage-Maximum Inputs	$726.32
2--Conventional Tillage-Standard Inputs	$963.98
3--Conservation Tillage-IPM, NM	$738.72
4--Conservation Tillage-Transgenic	$1,058.72

Residual Returns (Income over Expenses), 1997

Treatment	Residual Returns per Acre
1--Conventional Tillage-Maximum Inputs	$6.31
2--Conventional Tillage-Standard Inputs	$213.47
3--Conservation Tillage-IPM, NM	$18.73
4--Conservation Tillage-Transgenic	$350.52

Field Day participants listening to John Muse describe the DEQ nonpoint source projects in the area.

Field Day participants listening to Kathy McLean describe the DEQ best management practices in cotton production affects on runoff water quality.

Field day participants observing the best management practices plots.

Subject: Re: K. McLean's BMP project
Date: Thu, 17 Feb 2000 10:14:23 -0600
From: John Barnett <jbarnett@agctr.lsu.edu>
To: bibounds@alpha.nlu.edu

Buck,

There were two fields days that I was directly involved with. In 1997 we had a field day in August with about 150 people attending and in August, 1998 we had a field tour with about 80 people attending. The 1998 field tour was on August 20th, I have a file on it, but could not find the file on the 1997 one, but do remember it. We also had a field tour in August of 1996 with about 150 attending, but the program did not show where we had visited the BMP site. The NLU stop was looking at fungicides and lunch. I also remember one other smaller field day that was attended by 30 or 40 people sometime in 97 or 98. The whole focus of that one was the NLU, BMP project and it only lasted a couple of hours. In 1999, I did not have any groups on the NLU farm that I remember. Hope this helps.

bounds wrote:

> *1. John:*
> *Just a reminder for you to send me the information you have on the field days held at the NLU farm during the BMP project on cotton runoff. I appreciate your cooperation very much.*
>
> *Thanks a lot,*
>
> *Buck Bounds*
>
> *PS FAX = (318)342-3312 or e-mail = bibounds@ulm.edu*

--
John W. Barnett, Ph.D.
LSU Agricultural Center
Cotton Production Specialist
212 Macon Ridge Road Bldg. B
Winnsboro, LA 71295
Phone: 318-435-2908
Fax: 318-435-2902
Mobile: 318-282-6948

LOUISIANA ACADEMY OF SCIENCES

Call for Paper Titles & Abstracts

ANNUAL MEETING - FIRST THURSDAY, FRIDAY AND SATURDAY OF FEBRUARY

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Bray, C. Shane[1], K. S. McLean[1], G. W. Lawrence[2], B. Bounds, and R. H. Neal. [1] NLU and [2] MSU. Cotton runoff water quality as affected by tillage practices in Louisiana. – A cotton tillage test was conducted by N LU in coorporation with LA DEQ and NRCS to determine the benefits of conservation tillage to runoff water quality. Treatments consisted of (1) conventional tillage, (2) conventional tillage + integrated pest management (IPM) + cover crop, (3) conservation tillage + IPM and (4) conservation tillage + IPM + cover crop + transgenic cotton. Water samples were collected five times during the growing season. Ammonia nitrogen, nitrate nitrogen, phosphorus, total suspended solids, and pH concentrations in the runoff water were determined after each rain event. The amount of total suspended solids were greater in the conventional tillage compared to the conservational tillage treatments at all rain events. No significant difference in the amount of ammonia nitrogen, nitrate nitrogen, and phosphorus was observed between treatments. Seed cotton yield was greater in the tillage treatments which included the cover crop compared to those without.

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